The Value of Composite Y Graft Using Bilateral Skeletonized Internal Mammary Artery in Coronary Artery Bypass Operation

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The value of composite Y graft using bilateral skeletonized internal mammary artery in coronary artery bypass operation

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Background:

Total arterial revascularization using composite grafts from bilateral internal mammary arteries (BIMAs) has gained great interest in the last two decades, in order to improve the short and long term outcomes of CABG operations.

Objective:

The aim of this work is to evaluate the safety and efficiency of coronary artery bypass graft (CABG) operation with composite Y graft using bilateral internal mammary artery by following the short term clinical outcome.

Methods:

Between November 2009 and May 2012, 104 patients undergoing coronary artery bypass grafting were revascularized using a composite Y graft from skeletonised

BIMAs. Saphenous venous grafts (SVGs) were used to complete revascularization in 52 (50%) of patients. The mean age was 52.78 ± 7.9 years. Six (5.8%) patients were females. Preoperative, intraoperative, and postoperative data were collected in a prospective manner. Troponin I (Tn I) was measured preoperative, and at 6, 12, and 24 hours postoperative in blood samples.

Results:

The mean number of anastomoses for patients was 3.01± 0.66 (range 2–4). The mean cross-clamp time was 54.37±14.9 min (range 16–95 min), and the mean extracorporeal circulation time was 87.27±23.9 min (range 40–150 min). Six patients were operated off-pump (5.8%). The intraoperative mortality was 1% (1 patient). The incidence of postoperative arrhythmia was 5.8 %, peri-operative infarction 1.9 % (elevated Tn I), re-operation for bleeding 4.8% and deep sternal wound infection 1%.

Conclusion:

The technique of using composite Y graft from both internal mammary arteries for coronary revasularisation is relatively efficient, and safe according to short term clinical and biochemical follow up.

Keywords: Coronary artery bypass grafting. Arterial grafts. Myocardial infarction. Sternal wound infection.

Contents

Chapter	Page No.
Introduction	I
Aim of the work	III
Historical background	1
Surgical anatomy	4
Indications for coronary revascularisation	10
Conduit options in coronary artery bypass surgery	22
Conduct of the operation	42
Outcome of CABG operation using the composite Y graft	55
OPCAB	77
Patients and methods	98
Results	108
Discussion	139
Summary and Conclusion	158
References	162
الملخص العربى	

List of Abbreviations

Abbrev.	*Meaning*
AHA/ACC	*American Heart Association and American College of Cardiology*
BIMA	*Bilateral internal mammary artery*
BMI	*Body mass index*
BSA	*Body surface area*
CABG	*Coronary artery bypass grafting*
CAD	*Coronary artery disease*
CAG	*Coronary angiography*
CCS	*Canadian Cardiovascular Society*
CCU	*Cardiac care unit*
COPD	*Chronic obstructive pulmonary disease*
CPB	*Cardiopulmonary bypass*
cTnI	*Cardiac Troponin I*
CVA	*Cerebrovascular accident*
CVP	*Central venous pressure*
CX	*Circumflex artery*
DM	*Diabetes mellitus*
ECG	*Electrocardiogram*
EF	*Ejection fraction*
GEA	*Gastroepiploic artery*
HbA1c	*Hemoglobin A1c*
IAB	*Intraaortic balloon*
ICU	*Intensive care unit*
IHD	*Ischemic heart disease*
IMA	*Internal mammary artery*
Int.	*Ramus intermedius artery*
IU	*International units*
LAD	*Left anterior descending artery*
LCX	*Left circumflex artery*
LIMA	*Left internal mammary artery*

Abbrev.	*Meaning*
LV	*Left ventricle*
LVEDV	*Left ventricular end diastolic volume*
LVESV	*Left ventricular end systolic volume*
LVEF	*Left ventricular ejection fraction*
LVF	*Left ventricular function*
MACCE	*Major adverse cardiac and cerebrovascular events*
MDCT	*Multidetector computed tomography*
MI	*Myocardial infarction*
mSV	*milliseverts*
NYHA	*New York Heart Association*
OM	*Obtuse marginal artery*
OPCAB	*Off pump -coronary artery bypass*
PCI	*Percutaneous coronary intervention*
PCV	*Packed cell volume*
PDA	*Posterior descending artery*
PTCA	*Percutaneous transluminal coronary angioplasty*
RA	*Radial artery*
RCA	*Right coronary artery*
RGEA	*Right gastroepiploic artery*
RIMA	*Right internal mammary artery*
SIMA	*Single internal mammary artery*
SSIs	*Surgical- site infections*
STS	*Society of thoracic surgeons*
SV	*Saphenous vein*
SVG	*Saphenous venous graft*
TEE	*Transesophageal echocardiography*
TTE	*Transthoracic echocardiography*
VF	*Ventricular fibrillation*

List of figures

Figure No.	Title	Page No.
1	Internal thoracic artery (ITA) harvest	29
2	Internal mammary artery T-graft (left), and radial artery T-graft (right)	35
3	Cannulation	43
4	Distal anastomosis	45
5	Distal anastomosis suture technique	48
6	Sequential anastomosis	50
7	Proximal anastomosis	52
8	Composite Y graft	53
9	Compressive-type stabilizers	83
10	Vacuum-assisted stabilizers	84
11	Capture-type stabilizers	86
12	Deep pericardial sutures	88
13	The approximate locations for the deep pericardial sutures	89
14	The right vertical pericardiotomy	91
15	Tilting the right hemisternum	94
16	Apical suction devices	94
17	An apical suction device, when used in conjunction with right hemisternal elevation, vertical pericardiotomy, and right pleurotomy, provides optimal exposure of the high lateral wall	95
18	Age and Sex distribution in all patients	108

19	Body surface area and Body mass index distribution in all patients	109
20	CCS Angina grading compared to NYHA Dyspnea status in all patients	111
21	Illustrated preoperative risk factors of all study patients.	113
22	Illustrated Ejection Fraction preoperative in all patients in the study group	114
23	Illustrated Cumulative bypass Time in 97 patients	118
24	Illustrated Cumulative aortic cross clamp time in 97 patients	119
25	Illustrated Time per graft in all patients in the study	119
26	Illustrated number of blood units used in all patients in the study	121
27	Illustrated hemoglobin on discharge in all patients in the study	122
28	Illustrated ventilation time in all patients in the study	124
29	Illustrated ICU stay time in all patients in the study	125
30	Illustrated postoperative stay time in all patients in the study	125
31	Illustrated Ejection Fraction postoperative in all patients in the study group	126
32	Illustrated Troponin I 6 hours postoperative in all patients in the study group	130
33	Illustrated Troponin I 12 hours postoperative in all patients in the study group	130
34	Illustrated Troponin I 24 hours postoperative in all patients in the study group	131

List of tables

Table No.	Title	Page No.
1	Origin of the Internal Mammary Arteries	5
2	Level of Termination of Internal Mammary Artery	8
3	Canadian Cardiovascular Society angina classification	12
4	AHA/ACC guidelines for CABG	14
5	Conduits for CABG	23
6	Patency of Free IMA in Bilateral Grafts	33
7	OPCAB Patient Selection in Early Experience	79
8	Patients Most Likely to Benefit from OPCAB	79
9	Essentials of Anesthetic Management in OPCAB Essentials of Anesthetic Management in OPCAB	81
10	Medical characteristics and preoperative risk factors	112
11	Average Ejection Fraction of all patients in the study group preoperative	113
12	Number of Distal Coronary Anastomoses	115
13	Coronary targets of RIMA	115
14	Coronary targets of LIMA	116
15	Coronary targets of SVGs	117
16	Off pump and on pump CABG	117
17	Average bypass time, cross clamp time, and time per graft	118
18	Comming off bypass	120
19 A	Postoperative data (descriptive statistics)	126
19 B	Postoperative data (frequencies)	127

20	**Average Troponin I in the study population (ngm/ml)**	**128**
21	**Paired Samples Test (Troponin I)**	**129**
22	**Average Troponin I in 102 patients from the study population (ngm/ml)**	**129**
23	**Paired Samples Statistics (Ejection fraction pre and postoperative)**	**132**
24	**Paired samples test (Ejection fraction pre and postoperative)**	**132**
25	**Postoperative outcome in Diabetic versus Non Diabetic patients**	**133**
26	**Postoperative outcome in total arterial revasularisation versus adjuvant venous revasularisation (qualitative)**	**134**
27	**Preoperative, Operative and postoperative data in total arterial revasularisation versus adjuvant venous revasularisation (quantitative measures)**	**135**
28	**Correlation between Troponin levels and bypass-XC times**	**136**

INTRODUCTION

Saphenous vein grafts undergo a degenerative change in the intermediate to long term that ultimately limits graft patency. As a result there has been a trend to use arterial grafts in younger patients. **(Ian A. Nicholson and Hugh S. Paterson, 1997**)

The internal thoracic artery is widely recognized as the ideal graft for coronary artery bypass procedures. Its high rate of long-term patency is due to the low risk of intimal thickening and to the freedom from major atheromatous disease in this elastic conduit. (**Badih El Nakadi et al, 2000)**

The left internal thoracic artery (LITA) is the best graft for bypassing stenoses of the left anterior descending coronary artery (LAD). The right internal thoracic artery (RITA), used in the same circumstances as the LITA, may offer the same results. Therefore, the use of bilateral in situ internal thoracic artery (ITA) grafts has gained prominence. This development is however restricted by three factors: the risk of sternal devascularization and ischemia resulting in sternal wound complications, insufficient length of the RITA pedicle, and the necessity to cross the midline. (**Sidney Chocron et al, 1994)**

To obtain multiple coronary revascularization using only the internal thoracic arteries (ITA), a composite graft in which a free right ITA (RITA) is attached to the side wall of a left ITA (LITA) has been applied. In this type of composite graft, the blood flow to the myocardium perfused by the grafted coronary arteries depends on the blood supply from the LITA. (**Masami Ochi et al, 2001)**

This procedure provides additional length to reach a distal coronary artery branch and reduces sternal devascularization by preserving the first RITA collateral artery. (**Sidney Chocron et al, 1994)**

Sequential grafting uses one conduit for more than one distal anastomosis and is therefore more efficient. Since most patients receive more than two anastomoses, sequential grafts are frequently required when using composite grafts. (**Alistair G. Royse et al, 1999)**

Calafiore has suggested that conduits arising from the aorta may experience more turbulence and potentially endure more intimal damage than composite conduits arising from the left internal mammary artery (LIMA). Since the results of late patency of LIMA to left anterior descending artery are so good, this Y graft operation, being a modified version of this same graft, could have a similar outcome. A possible benefit of avoidance of aortic anastomoses may be by reduced cerebral embolism manifest by reduced neuropsychological dysfunction and stroke. This may result from a greater freedom to move aortic cannulation and clamping sites when aortic atheroma is detected by echocardiography and from reduced aortic manipulation during construction of proximal anastomoses. (**Alistair G. Royse et al, 1999)**

We should not disregard another important reason for encouraging total arterial revascularization: the lower limb complications derived from the use of saphenous veins are avoided. This, in turn, may result in earlier ambulation, a shorter hospital stay, and a faster return to daily activities. (**Ernesto E. Weinschelbaum et al, 1997)**

AIM OF THE WORK

The aim of this work is to evaluate the safety and efficacy of coronary artery bypass graft (CABG) operation with composite Y graft using bilateral internal mammary artery by following the short term clinical outcome.

HISTORICAL BACKGROUND

Dr. Ludwig Rehn, a surgeon in Frankfurt, Germany, performed what many consider the first successful heart operation. After repairing the first cardiac wound in 22 year old gardener he stated that: *This proves the feasibility of cardiac suture repair without a doubt! I hope this will lead to more investigation regarding surgery of the heart. This may save many lives.* ***(Rhen L, 1897)***

In 1876 Adam Hammer establishes that angina pain could be attributed to interruption of coronary blood supply and that heart attacks occurred when at least one coronary artery is blocked ***(Westaby S, 1997)***

Indirect methods to restore blood supply to the ischemic myocardium were pioneered by *Claude Beck (1935)* who reported in 1935 on the placement of a pedicled pectoralis muscle flap on the abraded pericardium.

Surgical attempts at increasing blood flow to the ischemic myocardium originated century ago when Alexis Carrel anastomosed a carotid artery segment between the descending aorta and left coronary artery in a dog, for which he was later awarded the Nobel prize ***(Carrel, 1910).*** The earlier surgical attempts to improve myocardial blood supply were indirect procedures. Cervical sympathectomy was suggested as a method of cardiac denervation and reduction of heart rate. ***(Francois- Frank, 1899)***

Three decades later, Arthur Vineberg started implanting the left internal thoracic artery (LITA) into the anterior myocardial territory of patients with CAD in order to