ORIGINAL ARTICLE

PERI-PROCEDURAL OUTCOME OF SAPHENOUS VEIN GRAFT INTERVENTION

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Background: Patients who develop recurrent myocardial ischemia after coronary artery bypass graft (CABG) surgery are often referred for percutaneous coronary intervention. The objective of this study was to evaluate the clinical characteristics and peri-procedural outcomes in patients with prior CABG referred for percutaneous coronary intervention (PCI) over a 3 year period. **Methods:** Data were collected on patients who underwent coronary interventional procedures following CABG surgery. We evaluated angiographic procedural success and immediate outcome among patients who had undergone such procedures from Nov 2006 to Oct 2009 (n=113). **Results:** Patients in the 2006–2009 cohort had mean age 58.2 years, more patients were male (109 vs 4) and were more likely to have hypertension (57.5%), hyperlipidaemia (72.6%) and family history of ischemic heart disease (IHD) (65.5%), but less likely to have smoking (42.5%). Acute closure of stent leading to procedural failure was seen in 1 (0.9%) patient, sub-acute thrombosis of stent was seen in 1 (0.9%) patient, dissection or perforation of target vessel was seen in 3 (2.7%) and 1 (0.9%) patients respectively. Slow flow phenomenon was seen in 13 (11.5%) and post-procedural cardiac enzymes were raised in 6 (5.3%) patients. **Conclusion:** Success rates of saphenous vein graft (SVG) intervention and survival rate have improved with time as a result of improvements in technique and greater use of stents, filter devices and adjunctive medications.

Keywords: Percutaneous coronary intervention, saphenous vein graft, Ischemic heart disease, IHD

INTRODUCTION

As surgical coronary revascularization enters its fifth decade, a growing patient population faces the need for repeat revascularization. It is estimated that up to 10% of saphenous vein grafts (SVG) become occluded by the end of 1 year, followed by an additional attrition rate of 3–5% per year. Thus, at 10 years after operation, only 40–60% of bypass grafts are functional.[1,2] Annual incidence of acute ischemic events in survivors of first bypass operation is 4–8%. These patients mostly have multi-vessel disease and they are usually receiving aggressive medical treatment at the time when they develop symptoms. Thus the crucial therapeutic decision is whether patient needs repeat coronary artery bypass graft surgery (CABG) or catheter based percutaneous coronary intervention (PCI).

Percutaneous coronary intervention (PCI) has been used to treat medically refractory myocardial ischemia in patients with prior CABG since the early 1980s, but even with the addition of stents, PCI of patients with prior CABG has been associated with worse outcomes than PCI of patients without prior CABG.[3,4]

MATERIAL AND METHODS

This prospective study was conducted in Punjab Institute of Cardiology over a period of three years (from November, 2006 to October, 2009). Patients were included in the study if they fulfilled following clinical, laboratory and angiographic criteria: i) History of having CABG previously; ii) Development of ischemic symptoms after CABG; iii) Graft study showing critical stenosis in sephaneous vein graft; iv) Patient willing for undergoing percutaneous intervention to saphenous vein graft.

Detailed history and physical examination was done at the time of admission. Before procedure every patient was loaded with 300 mg of clopidogrel and graft study was reviewed. During procedure all patients received intravenous un-fractioned heparin according to body weight. Use of filter device, glycoprotein IIa IIIb inhibitor and type of stent (drug eluting stent or bare metal stent) was at the discretion of operator.

Following points were noted after procedure to evaluate procedural outcome: (i) Acute closure; (ii) slow flow phenomenon; (iii) sub-acute thrombosis of stent; (iv) dissection of target vessel; (iv) perforation of target vessel; (v) procedural failure; (vi) post-procedural cardiac enzymes; (vii) contrast reaction; (viii) Major haematoma formation and need of blood transfusion.

RESULTS

Between November 2006 and October 2009, 113 patients were enrolled. Baseline characteristics are shown in Table-1. Although mean age was 58.2±9.4 years, our study contain both young (age less than 40 years) as well as old patients (age above 75 years). Majority of population was male (96.5%). Among risk factors of atherosclerosis, 73.5% had hyperlipidaemia, 66.4% had family history of IHD, 57.5% were hypertensive, 44.2% were diabetic and 42.5% were smokers. Majority of patients presented with either

unstable angina or stable angina while one third of patients presented with STEMI or NSTEMI.

Table-1: Baseline characteristics of the study population [n (%)]

Variables	Value
Age (Mean±SD)	58.2±9.4
Gender	
Male	109 (96.5%)
Female	4 (3.5%)
Diabetes	50 (44.2%)
Hypertension	65 (57.5%)
Smoking	48 (42.5%)
Hyperlipidemia	83 (73.5%)
Family History of IHD	75 (66.4%)
Mode of Presentation	
Unstable Angina	34 (30.1%)
Stable Angina	33 (29.2%)
ST elevation MI	20 (17.7%)
NSTEMI	26 (23.0%)

Table-2 shows angiographic and procedural characteristics. Majority of stents were deployed in SVG to OM or RCA (36.3% and 30.1% respectively). Filter wire EZ was used in 14 (12.4%) and Export Aspiration catheter was used in 4 (3.5%). Bare metal stents were used in 58 (51.3%), drug eluting stents were used in 53 (46.9%) and in 2 (1.8%) patients, only balloon angioplasty was done. Among bare metal stents (stainless steel), Flex master, Coro flex and Liberte were used while among drug eluting stents (sirolimus, evorolimus or paclitaxel coated), Xience V, Promus, Cypher and Texus were used.

Table-2:- Angiographic and procedural characteristics

Parameter	Value n (%)
Name of Target vessel: (SVG to)	
LAD (Left Anterior Descending)	15 (13.3%)
D1 (First Diagonal)	10 (8.8%)
CX (Circumflex)	3 (2.7%)
OM1 (First Obtuse Marginal)	41 (36.3%)
OM2 (Second Obtuse Marginal)	4 (3.5%)
RCA (Right Coronary artery)	34 (30.1%)
PDA (Posterior Descending Artery)	3 (2.7%)
Ramus Inter-medius	3 (2.7%)
Filter Wire or Device used	
Filter Wire EZ	14 (12.4%)
Export Aspiration Catheter	4 (3.5%)
Type of Stent used	
Drug eluting stent	53 (46.9%)
Bare metal stent	58 (51.3%)
Not used (balloon only)	2 (1.8%)
Brand name of stent	
Flex Master	55 (48.7%)
Coro Flex	2 (1.8%)
Liberte	1 (0.9%)
Xience V	18 (15.9%)
Promus	8 (7.1%)
Cypher	22 (19.5%)
Taxus	5 (4.4%)
Glycoprotein IIa/IIIb Inhibitor	
Tirofiban	19 (16.8%)
Eptifibatide	39 (34.5%)
Abciximab	42 (37.2%)
Clopidogrel	113 (100%)
Mean Inflation Pressure	15.18±3.3
Mean Diameter of stent used	3.0686±0.61
Mean Length of stent used	19.82±6.7

Table-3 shows the peri-procedural outcome of percutaneous intervention of saphenous vein grafts. The angiographic primary success rate per lesion was 86% for bypass grafts stenosis while adverse outcomes were seen in 16 out of 113 patients. Twenty seven complications occurred in 16 patients. Death occurred in only 1 (0.9%) patient and cause of death in this patient was sub-acute thrombosis of stent. Slow flow phenomenon was observed in 13 (11.5%) patients. Dissection of target vessel occurred in 3 (2.7%) patients. Acute Closure and Perforation occurred in 1 (0.9%) patients each. The Procedural failure occurred in only 1 (0.9%) patient. In this target lesion was calcified and could not be crossed despite use of various wires. The Procedure was abandon in this patient without any complication. Myocardial injury as evidenced by significant increase in cardiac enzymes within 24 hrs of procedure occurred in 6 (5.3%) patients. Among these 6 patients, 5 patients developed MI after slow flow phenomenon and only one patient had MI due to perforation of target vessel.

Table-3: Peri-procedural Outcome

	No. (%)
Any adverse Outcome	16 (14.2)
Acute Closure	1 (0.9)
Slow flow phenomenon	13 (11.5)
Sub-acute thrombosis of stent	1 (0.9)
Dissection	3 (2.7)
Perforation	1 (0.9)
Procedural failure	1 (0.9)
Post procedural raised CPK	6 (5.3)
Death during hospital stay	1 (0.9)
Emergency CABG	0 (0)
Contrast Reaction	0 (0)
Major Hematoma and need for blood transfusion	0 (0)

DISCUSSION

Coronary artery bypass surgery (CABG) has enabled a large number of patients to obtain 5–10 years of useful life with anginal symptoms relieved or improved. However, symptoms recur or progress in about 5% of patients per year.[5–8] Percutaneous treatment of SVG obstructions is difficult because it often results in inadequate dilatation, a high likelihood of distal embolization associated with mortality and significant morbidity, and a high restenosis rate.[9]

In patients who had coronary bypass surgery and in which vein grafts were used, majority are reluctant to see a cardiovascular surgeon professionally again after the first CABG operation. Re-operation is technically more difficult and is generally associated with a higher morbidity and mortality than the first surgical procedure. Furthermore, following re-operation 30–40% of patients may not experience improvement in their angina.[10–15] Thus there is continued need for development of approaches to treat such patients.

Although in our study, mean age is 58.2±9.4 years, some patients are more than 75 years old. There are many unique characteristics of patients treated for

vein graft disease: they are older than when they had their initial procedure, and more importantly, their vein grafts are also older. Beyond 1year and particularly >3 years after surgery, atherosclerosis of vein grafts becomes increasingly prevalent.[1,16–19] It may coexist with intimal fibro-muscular proliferation and, in patients with acute ischemic syndromes, thrombus of varying ages. Atherosclerotic plaques in vein grafts are often large compared with plaques in native coronary arteries and are usually soft and friable, rich in necrotic debris, cholesterol crystals, blood elements, and foam cells. Thrombus has been documented by angioscopy in up to 70% of vein graft lesions undergoing treatment.[20] This substrate is primarily responsible for the problems encountered during interventional procedures, which include distal embolization, inadequate dilatation, increased restenosis rates and reduced ante-grade blood flow leading to slow or no reflow phenomenon. The incidence of peri-operative acute myocardial infarction is reported to range between 2.7–10.6%[21], which also corresponds to our study, i.e., 5.3%.

Since SVGs lack side branches, distal occlusion results in stasis and thrombus formation throughout the graft, which makes PCI more difficult.[22] Thus, as with bypass surgery, outcomes after PCI for SVG stenosis are often worse than in native vessels.[22] This was illustrated in a pooled analysis of five randomized glycoprotein IIb/IIIa inhibitor trials in which PCI for SVG stenosis was associated with significant increase in mortality at both 30 days (2.1 versus 1.0 % compared to PCI in native vessels) and six months (4.7 versus 2.0 %).[23] Mortality rate in our study is 0.9% which is less than other studies. This may be due to better case selection as well as use of stents, filter devices and adjunctive medications.

The mechanism of slow or no-reflow phenomenon is complex and various theories have been proposed. This phenomenon is probably due to a combination of multiple patho-physiological mechanisms which may have a different role in different clinical and procedural settings. The postulates include: spasm of the distal microcirculation and recently the distal embolization of pieces of lipid rich plaque.[24] Slow flow phenomenon complicates 10–15% of PCI in SVG.[24] In our study, it occurred in 11.5% of cases which compare favourably with other reports.

It is especially important that graft problems be investigated early; since stenosis in these vessels can progress rapidly to total thrombotic occlusion.[25] A heavy thrombus burden in an SVG markedly increases the difficulty in obtaining a satisfactory result using a catheter technique. In our study procedural failure occurred in only 1 (0.9%) patient. In this target lesion was calcified and lesion could not be crossed despite using various wires. Although most patients with recurrent angina due to SVG stenosis can be managed medically, cardiac catheterisation should be performed at the earliest signs of recurrent ischemia to detect critical graft lesions that can be treated before irreversible loss of the graft.

Table-4 compares some of our results with other reports.[21,26–35]

Table-4: Comparison of results with other studies

First Author	Patients (n)	SVG attempted lesions (n)	Primary Success (%)	Myocardial Infarction (%)	Emergency CABG (%)	Deaths (%)
Meester[21]	84	93	84	8.3	2.4	1.2
Pinkerton[26]	236	100	93	NA	3	0.4
Block[27]	40	40	78	0	2.5	NA
Dorros[28]	61	33	79	4.9	1.6	3.3
Douglas[29]	116	62	94	1.7	2.6	0
El Gamal[30]	31	44	93	6.5	0	0
Cote[31]	82	101	85	3.7	1.2	0
Corbelli[32]	94	47	92	2.1	4.3	1.1
Ernst[33]	83	33	97	2.4	0	0
Reeder[34]	19	19	84	5.3	0	5.3
Cooper[35]	59	24	75	5.1	0	1.7
Present Study	113	113	86	5.3	0	0.9

CONCLUSION

Percutaneous revascularisation of the saphenous vein grafts can be performed with high procedural success and low rate of in-hospital complications and is a good alternative to re-operation in some patients with previous bypass surgery. Success rates and survival have improved with time as a result of improvements in techniques and greater use of stents, filter devices and adjunctive medications in patients who undergo percutaneous intervention following CABG surgery.

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