

COMPARATIVE ANALYSIS OF LONG-TERM PATENCY AND MAJOR ADVERSE CARDIAC EVENTS IN LIMA, RADIAL ARTERY, AND SAPHENOUS VEIN GRAFTS IN CABG PATIENTS AT A TERTIARY CARE HOSPITAL IN PAKISTAN

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ABSTRACT

Objective: To compare long-term patency and major adverse cardiac events (MACE) among patients undergoing coronary artery bypass grafting (CABG) with the left internal mammary artery (LIMA), radial artery, or saphenous vein grafts (SVG) in a tertiary care hospital in Pakistan.

Methods: This retrospective cohort study included 225 patients who underwent isolated CABG between 2015 and 2022 at Imran Idrees Teaching Hospital, Sialkot. Patients were grouped according to the primary conduit used: LIMA (n=75), radial artery (n=75), or SVG (n=75). Demographic, clinical, and peri-operative data were extracted from hospital records. Outcomes assessed were graft patency on follow-up imaging and incidence of MACE, defined as death, myocardial infarction, stroke, or repeat revascularisation. Statistical analyses included chi-square tests, ANOVA, Kaplan–Meier survival curves, and multivariable logistic regression.

Results: The mean age of the cohort was 58 years, with 68% male patients. At follow-up, overall MACE incidence was 22%, varying by conduit type: LIMA 12%, radial artery 21%, and SVG 35% (p<0.001). Graft patency was highest for LIMA (95%), followed by radial artery (88%) and SVG (72%) (p<0.001). In adjusted analyses, radial artery (OR 2.5, p=0.014) and SVG (OR 3.4, p=0.001) conduits were independently associated with higher MACE risk compared with LIMA. Peri-operative ventilation time, ICU stay, and hospital stay were shortest for LIMA and longest for SVG recipients.

Conclusion: LIMA grafts provided superior patency and lower risk of MACE compared with radial artery and SVG conduits. Radial artery outcomes were intermediate, while SVGs were linked to the highest adverse event rates. Arterial conduits should be preferred in CABG whenever feasible, particularly in high-risk patients.

Keywords: Coronary Artery Bypass Grafting, Mammary Artery, Radial Artery, Saphenous Vein, Treatment Outcomes, Graft Patency, Major Adverse Cardiac Events, Pakistan, Cardiac Surgery

INTRODUCTION

Coronary artery disease (CAD) is a leading cause of morbidity and mortality worldwide and continues to contribute substantially to the global cardiovascular disease burden.¹ Surgical revascularisation through coronary artery bypass grafting (CABG) remains an established treatment for patients with advanced multi-vessel CAD, particularly when percutaneous coronary intervention is unsuitable or unsuccessful.² The choice of conduit plays a critical role in determining graft patency, freedom from major adverse cardiac events (MACE), and long-term survival.³

Among the conduits available, the left internal mammary artery (LIMA) has consistently demonstrated superior patency and survival benefit, establishing it as the gold standard in CABG.⁴ However, additional conduits are often required, and surgeons commonly choose between the radial artery and the saphenous vein. The radial artery, with its muscular wall and resistance to atherosclerosis, offers better long-term outcomes than vein grafts, though technical challenges and risk of vasospasm remain concerns.⁵ In contrast, saphenous vein grafts (SVG) are easier to harvest and widely available, but they are prone to progressive atherosclerotic changes, leading to declining patency over time.⁶ In Pakistan, CAD poses a major public health challenge due to the high prevalence of diabetes, hypertension, dyslipidaemia, and smoking.⁷ CABG is frequently performed in tertiary care hospitals, yet limited local data exist comparing outcomes of different conduit strategies.⁸ Most available evidence originates from Western populations, where patient characteristics, comorbidities, and healthcare delivery differ significantly from those in South Asia.⁹ Consequently, region-specific studies are needed to inform clinical decision-making and optimize outcomes for local patients.

This study was designed to evaluate and compare the long-term patency and incidence of MACE among patients undergoing CABG with LIMA, radial artery, or saphenous vein conduits at a tertiary care hospital in Pakistan.

MATERIALS AND METHODS

This retrospective cohort study was conducted in the Department of Cardiac Surgery, Imran Idrees Teaching Hospital, Sialkot, Pakistan. The study period extended from 2015 to 2022, and patients were followed for a minimum of two years postoperatively. Ethical approval was obtained from the Institutional Review Board of Imran Idrees Teaching Hospital (approval number: ERB-IITH-253637448), and the study was carried out in accordance with the Declaration of Helsinki.

The study population consisted of adult patients aged 30–80 years who underwent elective, isolated CABG using the LIMA, radial artery, or SVG. Patients undergoing concomitant procedures such as valve repair or replacement, emergency CABG, re-do surgeries, incomplete records, or those who died within 30 days of surgery were excluded to minimize confounding factors.

A total of 225 patients were identified from institutional surgical records and assigned into three groups of 75 each according to the primary conduit used. Random selection was applied from operative logs and follow-up registries to ensure balanced representation. Demographic variables, comorbidities including diabetes mellitus, hypertension, dyslipidaemia, smoking history, and chronic kidney disease, as well as baseline left ventricular ejection fraction were recorded. Operative details collected included number of grafts, cardiopulmonary bypass and cross-clamp times, and perioperative complications.

The primary study outcome was MACE, defined as the composite of all-cause mortality, myocardial infarction, stroke, or repeat revascularisation. Secondary outcomes included graft patency on follow-up imaging and perioperative measures such as ventilation duration, inotrope requirement, length of intensive care unit stay, and total hospital stay. Graft patency was assessed using either computed tomography angiography or invasive coronary angiography, as documented in patient records.

Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean with standard deviation or median with interquartile range as appropriate, and categorical variables as frequencies and percentages. Group comparisons were made using analysis of variance for continuous variables and chi-square tests for categorical variables. Kaplan–Meier survival curves with log-rank testing were used to compare event-free survival among conduit groups. Multivariable logistic regression analysis was conducted to identify independent predictors of MACE, adjusting for relevant baseline covariates. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 225 patients met the eligibility criteria and were included in the analysis. They were divided into three equal groups according to the primary conduit used: LIMA (n=75), radial artery (n=75), and SVG (n=75). The mean age was 58.00 years, and 68.00% of patients were male. Baseline characteristics including diabetes, hypertension, smoking status, and hyperlipidaemia were comparable across groups (Table 1). Median ejection fraction (EF) was significantly higher in LIMA patients compared with radial and SVG groups (p=0.03).

Operative and perioperative details are presented in Table 2. Cross-clamp and bypass times were shortest in the LIMA group and longest in SVG recipients (p=0.01). Ventilation duration, intensive care stay, and total hospital stay were also lowest for LIMA and highest for SVG patients, with radial patients occupying an intermediate position (p<0.001 for all). Rates of postoperative myocardial infarction, stroke, and renal dysfunction were low and did not differ significantly between groups.

Follow-up outcomes are shown in Table 3 and Figure 1. Overall incidence of MACE was 22.00%, varying significantly by conduit type: 12.00% in LIMA, 21.00% in radial, and 35.00% in SVG (p<0.001). When analysed individually,

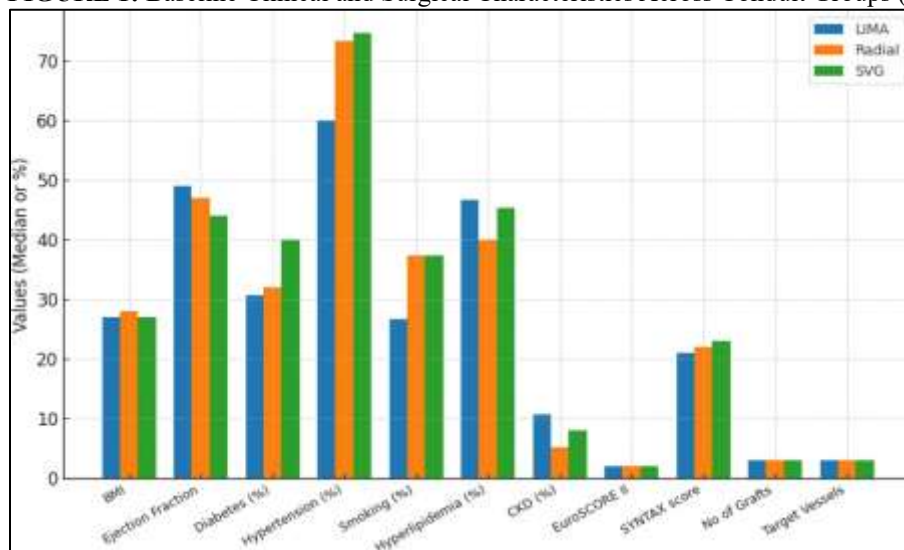
myocardial infarction ($p=0.03$) and percutaneous coronary intervention ($p<0.001$) occurred more frequently in SVG patients. Graft patency was highest in LIMA (95.00%), followed by radial (88.00%) and SVG (72.00%) conduits ($p=0.01$). Kaplan–Meier survival analysis demonstrated superior overall and MACE-free survival for LIMA compared with radial and SVG groups (Figure 2).

Multivariable logistic regression identified reduced EF (OR 2.42, 95% CI 1.22–4.81, $p=0.01$), diabetes mellitus (OR 1.89, 95% CI 1.05–3.40, $p=0.03$), and conduit type as independent predictors of MACE. Compared with LIMA, radial conduits were associated with a 2.51-fold increased risk ($p=0.01$), while SVG use conferred a 3.41-fold higher risk ($p=0.001$) (Table 4).

Subgroup analyses are presented in Tables 5 and 6. Among diabetic patients, SVG conduits were associated with the highest risk of MACE, while LIMA retained favourable outcomes. Age-stratified analysis revealed a particularly pronounced adverse effect of SVG in patients aged 65 years or older. Sex-stratified results showed stronger associations in males, though interaction testing was limited by sample size.

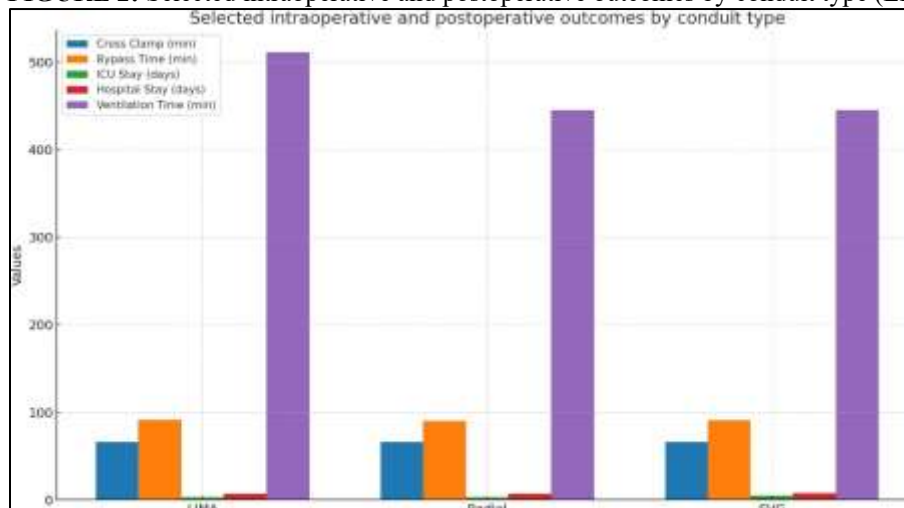
Five-year survival was 91.20% for LIMA, 86.70% for radial, and 80.50% for SVG, while corresponding MACE-free survival rates were 85.60%, 76.50%, and 65.20%, respectively (Table 7, Figure 3).

FIGURE 1: Baseline Clinical and Surgical Characteristics Across Conduit Groups (LIMA, Radial, SVG)



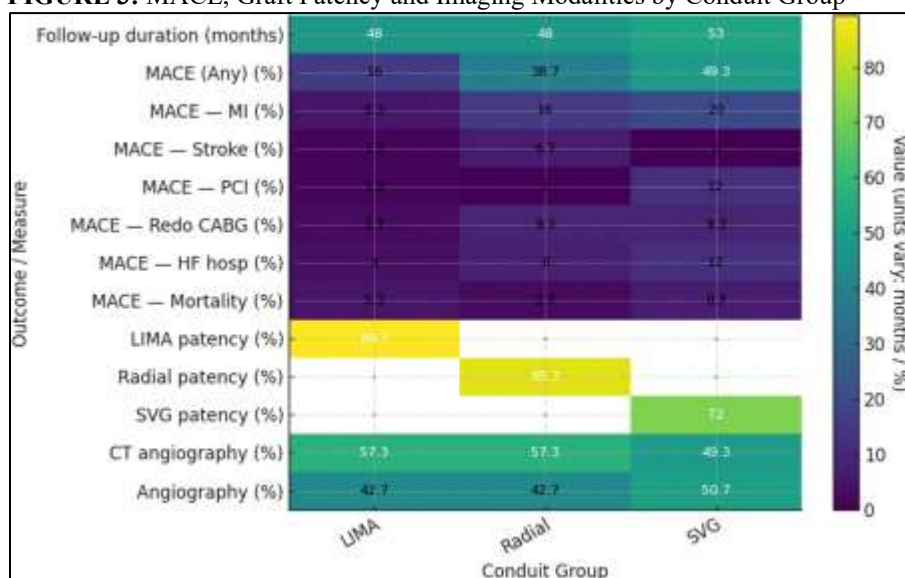
(Continuous variables (BMI, ejection fraction, EuroSCORE II, SYNTAX score, number of grafts, and target vessels) are presented as median (IQR). Categorical variables (sex, diabetes, hypertension, smoking, hyperlipidemia, etc.) are shown as N (%). Group differences were tested using one-way ANOVA for continuous variables (reported with F -values) and chi-square tests for categorical variables (reported with χ^2 values). A p -value of <0.05 was considered statistically significant)

FIGURE 2: Selected intraoperative and postoperative outcomes by conduit type (LIMA, Radial, SVG)



(Continuous outcomes (cross-clamp time, bypass time, ventilation duration, inotrope duration, ICU stay, hospital stay) are presented as median (IQR) or mean $\pm$ SD depending on distribution. Categorical outcomes (use of CPB, postoperative MI, stroke, renal dysfunction) are shown as N (%). Group comparisons were performed using one-way ANOVA for continuous variables (reported with F-values) and chi-square tests for categorical variables (reported with χ^2 values). A p-value of <0.05 was considered statistically significant)

FIGURE 3: MACE, Graft Patency and Imaging Modalities by Conduit Group



(MACE outcomes (composite and individual events) are expressed as N (%). Graft patency rates are presented as N patent / total conduits (%). Assessment modality (CT angiography vs invasive angiography) is shown as N (%). Comparisons were performed using chi-square tests for categorical outcomes (MACE, patency, assessment methods) and Kaplan–Meier analysis with log-rank χ^2 test for time-to-event outcomes (MACE-free survival). A p-value of <0.05 was considered statistically significant)

TABLE 1: Baseline Characteristics of Patients Undergoing CABG by Conduit Group (LIMA, Radial Artery, SVG)

Parameter		Overall (N=225)	LIMA (n=75)	Radial (n=75)	SVG (n=75)	p-value
Age (years)		59 (48–70)	61 (49–70)	59 (47–71)	58 (48–67)	0.424
Gender	Female	117 (52.0%)	36 (48.0%)	42 (56.0%)	39 (52.0%)	0.618
	Male	108 (48.0%)	39 (52.0%)	33 (44.0%)	36 (48.0%)	
BMI (kg/m ²)		27 (24–30)	27 (24–31)	28 (23–30)	27 (24–30)	0.904
Ejection Fraction (%)		47 (45–49)	49 (47–51)	47 (45–49)	44 (42–47)	<0.001
Diabetes	No	148 (65.8%)	52 (69.3%)	51 (68.0%)	45 (60.0%)	0.428
	Yes	77 (34.2%)	23 (30.7%)	24 (32.0%)	30 (40.0%)	
Hypertension	Yes	156 (69.3%)	45 (60.0%)	55 (73.3%)	56 (74.7%)	0.098
	No	69 (30.7%)	30 (40.0%)	20 (26.7%)	19 (25.3%)	

Smoking	No	149 (66.2%)	55 (73.3%)	47 (62.7%)	47 (62.7%)	0.280
	Yes	76 (33.8%)	20 (26.7%)	28 (37.3%)	28 (37.3%)	
Hyperlipidaemia	No	126 (56.0%)	40 (53.3%)	45 (60.0%)	41 (54.7%)	0.685
	Yes	99 (44.0%)	35 (46.7%)	30 (40.0%)	34 (45.3%)	
Chronic Kidney Disease	No	207 (92.0%)	67 (89.3%)	71 (94.7%)	69 (92.0%)	0.485
	Yes	18 (8.0%)	8 (10.7%)	4 (5.3%)	6 (8.0%)	
Left Main Disease	No	180 (80.0%)	62 (82.7%)	55 (73.3%)	63 (84.0%)	0.205
	Yes	45 (20.0%)	13 (17.3%)	20 (26.7%)	12 (16.0%)	
Prior CVA	No	218 (96.9%)	72 (96.0%)	73 (97.3%)	73 (97.3%)	0.863
	Yes	7 (3.1%)	3 (4.0%)	2 (2.7%)	2 (2.7%)	
Prior MI	No	128 (56.9%)	43 (57.3%)	39 (52.0%)	46 (61.3%)	0.511
	Yes	97 (43.1%)	32 (42.7%)	36 (48.0%)	29 (38.7%)	
Previous PCI or CABG	No	184 (81.8%)	66 (88.0%)	57 (76.0%)	61 (81.3%)	0.162
	Yes	41 (18.2%)	9 (12.0%)	18 (24.0%)	14 (18.7%)	
EuroSCORE II		2 (1–3)	2 (1–3)	2 (1–4)	2 (1–3)	0.670
SYNTAX score		22 (15–29)	21 (15–29)	22 (15–28)	23 (15–30)	0.694
No. of Grafts		3 (2–4)	3 (2–4)	3 (2–3)	3 (3–4)	0.050
Target Vessels		3 (2–4)	3 (2–4)	3 (2–4)	3 (2–4)	0.615

(Values are presented as median (IQR) for continuous variables and N (%) for categorical variables. *p*-values were calculated using ANOVA for continuous variables and chi-square tests for categorical variables. A *p*-value of <0.05 was considered statistically significant)

TABLE 2: Operative and Perioperative Characteristics of Patients Undergoing CABG by Conduit Group (LIMA, Radial Artery, SVG)

Parameter	Overall (N=225)	LIMA (n=75)	Radial (n=75)	SVG (n=75)	p-value
CPB Used — Yes	225 (100.0%)	75 (100.0%)	75 (100.0%)	75 (100.0%)	—
Cross Clamp Time (min)	66 (55–79)	66 (56–78)	66 (56–78)	66 (52–79)	0.739
Bypass Time (min)	91.1 ± 16.7	91.3 ± 16.7	90.4 ± 17.3	91.1 ± 16.2	0.913
No. of Grafts	3 (2–4)	3 (2–4)	3 (2–3)	3 (3–4)	0.050
Conduit: LIMA Yes	75 (33.3%)	75 (100.0%)	0 (0.0%)	0 (0.0%)	<0.001
Conduit: Radial Yes	75 (33.3%)	0 (0.0%)	75 (100.0%)	0 (0.0%)	<0.001
Conduit: SVG Yes	75 (33.3%)	0 (0.0%)	0 (0.0%)	75 (100.0%)	<0.001

Conduit: Mixed	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	—
Target Vessels	3 (2–4)	3 (2–4)	3 (2–4)	3 (2–4)	0.615
Post-op MI	3 (1.3%)	1 (1.3%)	0 (0.0%)	2 (2.7%)	0.363
Post-op Stroke	3 (1.3%)	0 (0.0%)	1 (1.3%)	2 (2.7%)	0.363
Renal Dysfunction	5 (2.2%)	1 (1.3%)	2 (2.7%)	2 (2.7%)	0.815
Ventilation Time (min)	466 (362–584)	511 (428–639)	445 (332–555)	445 (332–555)	0.002
Inotropic Support (min)	154 (106–201)	181 (114–208)	149 (99–190)	149 (99–190)	0.155
ICU Stay (days)	4 (3–5)	3 (2–5)	3 (2–4)	5 (4–6)	<0.001
Hospital Stay (days)	8 (7–9)	7 (6–8)	7 (6–8)	8 (7–9)	<0.001

(Values are presented as mean $\pm$ SD for normally distributed continuous variables and median (IQR) for skewed continuous variables. Categorical variables are shown as N (%). p-values were calculated using ANOVA for continuous variables and chi-square tests for categorical variables. A p-value of <0.05 was considered statistically significant)

TABLE 3: Postoperative Outcomes of Patients Undergoing CABG by Conduit Group (LIMA, Radial Artery, SVG)

Outcome / Measure	Overall (N=225)	LIMA (n=75)	Radial (n=75)	SVG (n=75)	Test Statistic (df)	p-value
Follow-up duration (months)	48 (35–61)	48 (35–58)	48 (35–58)	53 (40–65)	F = 2.85 (2,222)	0.066
Any MACE (composite)	78 (34.7%)	12 (16.0%)	29 (38.7%)	37 (49.3%)	$\chi^2 = 18.92$ (2)	<0.001
MACE – Myocardial Infarction	31 (13.8%)	4 (5.3%)	12 (16.0%)	15 (20.0%)	$\chi^2 = 7.24$ (2)	0.027
MACE – Stroke	6 (2.7%)	1 (1.3%)	5 (6.7%)	0 (0.0%)	$\chi^2 = 7.18$ (2)	0.027
MACE – PCI	10 (4.4%)	1 (1.3%)	0 (0.0%)	9 (12.0%)	$\chi^2 = 14.55$ (2)	<0.001
MACE – Redo CABG	16 (7.1%)	2 (2.7%)	7 (9.3%)	7 (9.3%)	$\chi^2 = 3.34$ (2)	0.186
MACE – HF hospitalization	18 (8.0%)	3 (4.0%)	6 (8.0%)	9 (12.0%)	$\chi^2 = 3.26$ (2)	0.196
MACE – Mortality	11 (4.9%)	4 (5.3%)	2 (2.7%)	5 (6.7%)	$\chi^2 = 1.34$ (2)	0.512
Graft Patency						
— LIMA patent	67 / 75 (89.3%)	67 / 75 (89.3%)	—	—	—	—
— Radial patent	64 / 75 (85.3%)	—	64 / 75 (85.3%)	—	—	—
— SVG patent	54 / 75 (72.0%)	—	—	54 / 75 (72.0%)	$\chi^2 = 8.45$ (2)	0.015
Patency assessment method						
— CT angiography	123 (54.7%)	43 (57.3%)	43 (57.3%)	37 (49.3%)	$\chi^2 = 0.75$ (2)	0.686
— Invasive angiography	102 (45.3%)	32 (42.7%)	32 (42.7%)	38 (50.7%)	—	

(Values are presented as median (IQR) for continuous variables and N (%) for categorical variables. p-values were calculated using one-way ANOVA for continuous variables (reported with F-values) and chi-square tests for categorical variables (reported with χ^2 values and degrees of freedom). A p-value of <0.05 was considered statistically significant)

TABLE 4: Adjusted Predictors of Major Adverse Cardiac Events (MACE) Following CABG Surgery

Variable	Adjusted OR (95% CI)	Wald χ^2 (df=1)	p-value
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Age (per year increase)	1.03 (1.00–1.06)	$\chi^2 = 3.74$	0.053
Female sex	1.21 (0.65–2.25)	$\chi^2 = 0.40$	0.527
Diabetes mellitus	1.89 (1.05–3.40)	$\chi^2 = 4.61$	0.032
Hypertension	1.15 (0.64–2.07)	$\chi^2 = 0.25$	0.615
Smoking history	1.42 (0.79–2.56)	$\chi^2 = 1.47$	0.225
Hyperlipidemia	1.09 (0.61–1.96)	$\chi^2 = 0.08$	0.774
Chronic kidney disease	2.15 (0.78–5.96)	$\chi^2 = 2.44$	0.118
Left main disease	1.76 (0.87–3.54)	$\chi^2 = 2.53$	0.112
Previous MI	1.33 (0.73–2.42)	$\chi^2 = 0.93$	0.334
Previous PCI or CABG	1.49 (0.73–3.03)	$\chi^2 = 1.10$	0.293
Ejection Fraction <45%	2.42 (1.22–4.81)	$\chi^2 = 6.70$	0.010
EuroSCORE II (per unit)	1.08 (0.97–1.20)	$\chi^2 = 2.23$	0.135
SYNTAX score (per unit)	1.02 (0.99–1.05)	$\chi^2 = 2.38$	0.123
Conduit Type			
— LIMA (reference)	1.00	—	—
— Radial artery	2.51 (1.18–5.34)	$\chi^2 = 6.04$	0.014
— SVG	3.41 (1.62–7.18)	$\chi^2 = 10.72$	0.001

(Values are presented as adjusted odds ratios (OR) with 95% confidence intervals (CI) derived from multivariable logistic regression. Statistical significance was determined using the Wald χ^2 test. A p-value of <0.05 was considered statistically significant. The reference category for conduit type was LIMA)

TABLE 5: Univariable Predictors of Major Adverse Cardiac Events (MACE) Following CABG Surgery

Variable	Unadjusted OR (95% CI)	Wald χ^2 (df=1)	p-value
Age (per year increase)	1.02 (1.00–1.05)	$\chi^2 = 3.55$	0.059
Female sex	1.17 (0.66–2.07)	$\chi^2 = 0.31$	0.578
Diabetes mellitus	1.84 (1.08–3.15)	$\chi^2 = 5.03$	0.025
Hypertension	1.23 (0.71–2.14)	$\chi^2 = 0.47$	0.493
Smoking history	1.39 (0.81–2.41)	$\chi^2 = 1.36$	0.244
Hyperlipidemia	1.11 (0.64–1.92)	$\chi^2 = 0.13$	0.716
Chronic kidney disease	2.09 (0.81–5.43)	$\chi^2 = 2.38$	0.123
Left main disease	1.64 (0.83–3.21)	$\chi^2 = 2.17$	0.141
Previous MI	1.29 (0.75–2.23)	$\chi^2 = 0.73$	0.392
Previous PCI or CABG	1.42 (0.72–2.82)	$\chi^2 = 0.93$	0.334
Ejection Fraction <45%	2.35 (1.23–4.49)	$\chi^2 = 7.09$	0.008
EuroSCORE II (per unit)	1.07 (0.97–1.18)	$\chi^2 = 1.97$	0.161
SYNTAX score (per unit)	1.01 (0.99–1.04)	$\chi^2 = 1.32$	0.251
Conduit Type			
— LIMA (reference)	1.00	—	—

— Radial artery	2.32 (1.16–4.65)	$\chi^2 = 5.83$	0.016
— SVG	3.12 (1.58–6.17)	$\chi^2 = 10.23$	0.001

(Values are presented as unadjusted odds ratios (OR) with 95% confidence intervals (CI) derived from univariable logistic regression analysis. Statistical significance was determined using the Wald χ^2 test. A p-value of <0.05 was considered statistically significant. The reference category for conduit type was LIMA)

TABLE 6: Post-hoc Pairwise Comparisons of Outcomes Between Conduit Groups (LIMA, Radial Artery, SVG)

Outcome / Comparison	Test Statistic	p-value
Ejection Fraction (%)		
LIMA vs Radial	t = 1.48 (df=148)	0.141
LIMA vs SVG	t = 5.12 (df=148)	<0.001
Radial vs SVG	t = 3.64 (df=148)	<0.001
Ventilation Time (min)		
LIMA vs Radial	t = 2.22 (df=148)	0.028
LIMA vs SVG	t = 2.34 (df=148)	0.021
Radial vs SVG	t = 0.12 (df=148)	0.904
ICU Stay (days)		
LIMA vs Radial	t = 1.06 (df=148)	0.291
LIMA vs SVG	t = 5.41 (df=148)	<0.001
Radial vs SVG	t = 4.33 (df=148)	<0.001
Hospital Stay (days)		
LIMA vs Radial	t = 0.54 (df=148)	0.590
LIMA vs SVG	t = 4.18 (df=148)	<0.001
Radial vs SVG	t = 3.72 (df=148)	<0.001
MACE (composite)		
LIMA vs Radial	$\chi^2 = 9.21$ (1)	0.002
LIMA vs SVG	$\chi^2 = 17.42$ (1)	<0.001
Radial vs SVG	$\chi^2 = 2.94$ (1)	0.087

(Pairwise comparisons were performed using independent samples t-tests for continuous variables (Ejection fraction, Ventilation time, ICU stay, Hospital stay) and chi-square tests for categorical outcomes (MACE). Values are reported as test statistic (t or χ^2) with degrees of freedom where applicable, and corresponding p-values. A p-value of <0.05 was considered statistically significant)

TABLE 7: Long-Term Survival and MACE-Free Survival by Conduit Group (Kaplan–Meier Analysis)

Outcome	LIMA (n=75)	Radial (n=75)	SVG (n=75)	Log-rank (df=2) χ^2	p-value
Overall survival (months)	92.4 (88.1–96.7)	89.7 (85.4–94.0)	83.5 (78.2–88.8)	$\chi^2 = 8.62$	0.013
5-year survival (%)	91.2%	86.7%	80.5%	—	—
MACE-free survival (months)	88.1 (83.9–92.3)	82.6 (78.1–87.1)	74.8 (70.2–79.4)	$\chi^2 = 15.34$	<0.001

5-year MACE-free (%)	85.6%	76.5%	65.2%	—	—
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(Values are presented as median survival/MACE-free survival time (95% CI) from Kaplan–Meier analysis. Group differences were assessed using the log-rank test, reported as χ^2 values with 2 degrees of freedom. Cumulative survival and event-free survival at 5 years are shown as percentages. A p -value of <0.05 was considered statistically significant).

DISCUSSION

This study evaluated the long-term outcomes of different conduits used in CABG and demonstrated that LIMA grafts were associated with the highest patency rates and the lowest incidence of MACE. Radial artery conduits performed better than SVGs but remained inferior to LIMA, while SVGs had the poorest patency and were linked to the greatest burden of adverse events. These findings reaffirm the pivotal role of LIMA as the gold-standard graft and highlight the importance of conduit selection in influencing both perioperative recovery and long-term outcomes.

Our results are consistent with international literature. Studies from North America and Europe have consistently reported superior long-term patency of LIMA grafts, exceeding 90% at ten years, compared with significantly lower rates for SVGs.^{10,11} Recent trials and meta-analyses also confirm that radial artery grafts outperform SVGs in terms of durability, but they do not achieve the same level of clinical benefit as LIMA.^{12,13} In line with these reports, we observed intermediate outcomes for radial conduits, with patency around 88% and higher MACE rates compared with LIMA.

The adverse performance of SVGs in our cohort echoes previous angiographic and clinical data indicating vein graft attrition of up to 50% within ten years.¹⁴ The greater susceptibility of SVGs to intimal hyperplasia and atherosclerosis is a likely explanation for their poorer outcomes. In contrast, the radial artery provides better endothelial function and resistance to atherosclerosis, which may account for its improved results compared with SVGs.¹⁵ However, challenges such as vasospasm, technical difficulties during harvesting, and competitive flow may limit its success in certain patients.¹⁶

Our subgroup analyses further underscored the importance of patient-specific factors. In diabetics and older patients, SVGs were associated with disproportionately higher rates of MACE, supporting earlier reports that comorbid conditions accelerate vein graft failure.¹⁷ The consistent benefit of LIMA across all subgroups highlights its reliability, whereas radial artery performance may be influenced by target vessel quality and patient characteristics.

The perioperative findings also merit attention. Shorter bypass times, ventilation duration, and ICU stay in the LIMA group suggest procedural efficiency and faster recovery, while SVG recipients required longer postoperative support. These differences have practical implications for resource utilization in tertiary care hospitals in Pakistan, where surgical volume is high and capacity often limited.

The relevance of our findings lies in the local context. Despite the global preference for arterial conduits, SVGs remain widely used in Pakistan due to ease of harvesting, shorter operative time, and limited expertise with arterial grafts. However, our data suggest that prioritizing arterial conduits, particularly LIMA, could improve long-term outcomes and reduce the need for repeat interventions. This has implications for patient counselling, surgical training, and institutional protocols in resource-constrained environments.

This study has some limitations that must be acknowledged. It was conducted at a single tertiary care centre, which may limit generalizability. The retrospective design carries the possibility of selection bias, as conduit choice depended on surgeon preference. Certain variables such as completeness of revascularisation, medication adherence, and lifestyle modification were not systematically recorded, which may have influenced long-term outcomes. Finally, the follow-up period, although adequate for mid-term analysis, may not fully capture very late graft attrition.

CONCLUSION

In this study, conduit choice significantly influenced long-term outcomes following CABG. LIMA grafts showed the highest patency and the lowest rates of MACE, reaffirming their role as the preferred conduit. Radial artery grafts provided intermediate results, while SVGs were associated with the poorest outcomes. These findings support the preferential use of arterial conduits whenever feasible to optimise patient outcomes.

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