Characteristics and Long-Term Outcomes of Patients With Prior Coronary Artery Bypass Grafting Undergoing Primary Percutaneous Coronary Intervention for ST-Segment Elevation Myocardial Infarction

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Limited data are available on characteristics and long-term outcomes of patients with coronary artery bypass grafts (CABG) undergoing primary percutaneous coronary intervention for ST-elevation myocardial infarction (STEMI). Between January 2000 to December 2014, we identified STEMI patients with prior CABG undergoing primary percutaneous coronary intervention from 3 sites. Kaplan-Meier methods to estimate survival and major adverse cardiac events (MACE) were employed and compared to a propensity matched cohort of non-CABG STEMI patients. Independent predictors of outcomes were analyzed with Cox modeling. Of the 3,212 STEMI patients identified, there were 296 (9.2%) CABG STEMI patients, having nearly similar frequencies of culprit graft (47.6%) versus culprit native (52.4%) as the infarct-related artery (IRA). At 10 years, the adjusted survival was 44% in CABG STEMI versus 55% in non-CABG STEMI (HR 1.26; 95%CI 0.86 to 1.87; p = 0.72). Survival free of MACE was lower for CABG STEMI (graft IRA, 37%; native IRA, 46%) as compared to non-CABG STEMI controls (63%) (p = 0.02). Neither CABG history nor IRA (native vs graft) was independently associated with death or MACE in multivariable analysis. Temporal trends showed no significant change in death or MACE rates of CABG STEMI patients over time. In conclusion, long term survival of CABG STEMI patients is not significantly different than matched STEMI patients without prior CABG; however, CABG STEMI patients were at significantly higher risk for MACE events. **(Am J Cardiol 2020;135:1−8)**

Patients with ST-elevation myocardial infarction (STEMI) with history of coronary artery bypass grafting (CABG) have accelerated atherosclerosis in native coronaries, saphenous vein graft (SVG) failure, high thrombus burden, higher baseline clinical and procedural risk,[1−3] and few management recommendations in guidelines.[4] CABG patients with STEMI have been shown to have lower procedural success during primary percutaneous coronary intervention (PCI) and higher rates of mortality and adverse events over short-term follow up.[1] In general, patients undergoing SVG PCI have an estimated 6% to 8% annual mortality[5,6] and, in the setting of STEMI, have a mortality as high as 30% at 1 year.[2] Although STEMI patients with prior CABG is not uncommon, data in this group has been limited to small cohorts, short-term follow up, and few adjusted comparisons to non-CABG STEMI patients.[7−10] In this study, we used the Mayo Clinic PCI registry to evaluate CABG patients presenting with STEMI and treated with primary PCI to determine the association between characteristics and long-term outcome in comparison to matched non-CABG STEMI patients.

Methods

Patients undergoing PCI at Mayo Clinic have been followed in a prospective registry since the registry's inception in 1979. Demographic, clinical, procedural variables, and clinical events are obtained. Trained staff contact patients after discharge to collect information on medication compliance, hospitalizations, and events. Patients are then contacted annually to collect event data, which are

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See page 8 for disclosure information.

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subsequently confirmed through review of medical records using standardized definitions. In addition, external medical records are obtained and reviewed. As part of quality assurance, 10% of all records are randomly audited for data integrity. For the purposes of this analysis, review of coronary images, PCI procedures, and presenting electrocardiogram (ECG) were performed in all cases as part of assuring data quality. The study was approved by the Institutional Review Board of Mayo Clinic. All patients with previous history of CABG, defined as any surgical coronary revascularization preceding the index STEMI, between January 2000 and December 2014 from 3 Mayo Clinic sites (Mayo Clinic, Rochester, MN, Mayo Clinic Health System, La Crosse, WI and Mayo Clinic Health System Mankato, MN) were included. From a total of 385 CABG STEMI patients, we excluded 67 patients with duplicated entries, 1 with a prior history of heart transplant, 2 with missing objective STEMI criteria, and 19 who did not provide authorization for use of their medical records for research, leaving a final cohort of 296 STEMI patients with prior CABG eligible for the study.

ECGs prior to emergent primary PCI were reviewed to confirm at least 2 mm of ST-segment elevation in 2 contiguous leads with subsequent activation of emergency primary PCI. Angiograms were reviewed in all cases to confirm use and type of distal protection devices for graft interventions, if applicable. myocardial infarction (MI) was diagnosed in the setting of 2 of the following 3 criteria: (1) chest pain for at least 20 minutes, (2) elevation of creatinine kinase (or the myocardial band fraction) >2× normal, and (3) new Q-wave on ECG. In-hospital deaths included all deaths during the index PCI hospitalization. Target vessel revascularization (TVR) was defined as urgent or emergent repeat PCI or CABG during the index hospitalization. Major adverse cardiac event (MACE) was defined as cardiac death, MI, or TVR. Significant coronary artery disease was defined as a stenosis ≥70% by visual assessment. Preprocedural shock was defined as prolonged systolic blood pressure <95 mm Hg in patients not on inotropes or intra-aortic balloon pump (IABP) and <110 mm Hg in patients on inotropes or IABP. Moderate and/or severe chronic kidney disease was defined by a serum creatinine level >3.0 mg/dl or a history of hemodialysis or renal transplant.

Continuous variables are summarized as means ± SD and categorical variables as frequency (percentage). Kaplan-Meier methods were used to estimate survival and MACE-free survival over time. These outcomes were analyzed both with PCI as time zero in all subjects, and with discharge as time zero in patients who survived to discharge. Comparisons between infarct-related artery (IRA) (i.e., native vs graft) groups were conducted with 2-sample *t* tests, Pearson chi-squared tests and the log-rank test, for appropriate corresponding variable types. A propensity score was developed from variables chosen by clinical relevance and imbalance between groups. The CABG STEMI patients were then matched to non-CABG STEMI patients in a ratio of 1:4. The method of matching was done by minimizing the average absolute distance across matched subsets. In-hospital and 5 year events were treated as binary outcomes and analyzed with logistic regression while long-term outcomes were analyzed using a multivariable Cox model.[11,12] Analyses were conducted with SAS version 9.4 (SAS Institute, Cary, NC) and R (R Foundation for Statistical Computing, Vienna, Austria).

Results

From 2000 to 2014, we identified 296 patients with a history of CABG that presented with STEMI and underwent primary PCI. There was nearly equal frequency of the IRA as culprit graft (47.6%) versus culprit native vessel (52.4%). Over the same time frame, a cohort of 2,916 STEMI patients without history of CABG was identified for comparison. Baseline characteristics are shown in Table 1. CABG STEMI patients differed from non-CABG STEMI patients with respect to most risk factors. Within the CABG STEMI group (i.e., culprit graft vs native), graft culprit patients were older and had higher rates of cerebrovascular disease, while shock and being a smoker were more commonly observed in patients with a native culprit. Procedural characteristics are depicted in Table 2. The territory supplied by the left anterior descending artery was least often treated in CABG STEMI patients as compared to non-CABG STEMI patients. Among patients with a graft as the culprit vessel, 97.9% underwent primary PCI to the graft, while 2.1% underwent primary PCI to the native vessel of the same territory. Conversely, a native artery culprit had primary PCI to the native in 92.9% of cases, while 7.1% underwent primary PCI to a graft of the same territory. TIMI flow grade 2-3 post PCI was lower in the CABG STEMI as compared to non-CABG STEMI patients. Discharge medications are shown in Table 3 and showed high and similar rates of recommended medications post MI prescribed in both CABG and non-CABG STEMI patients.

CABG STEMI patients were propensity matched on baseline characteristics to non-CABG STEMI (Appendix Table 1). Complications and in-hospital events were generally similar between CABG STEMI and matched non-CABG STEMI patients. Higher rates of adverse outcomes were more often observed in CABG STEMI patients as compared to non-CABG STEMI patients during follow up (Table 4). At 10 years, survival was 44% for CABG STEMI patients as compared to 55% for matched non-CABG STEMI patients (adjusted HR 1.26; 95%CI 0.86 to 1.87; $p = 0.72$ by log rank) (Figure 1). Among the CABG STEMI cohort, culprit lesion was not associated with any difference in long-term survival (49% for native vs 42% for graft) ($p = 0.91$) (Figure 2). MACE-free survival was lower for CABG STEMI patients (culprit graft, 37%; culprit native, 46%) as compared to non-CABG STEMI controls (63%) ($p = 0.02$) (adjusted HR 1.63; 95%CI 1.09 to 2.45) (Figure 3).

Independent predictors of death or MACE in this population included age, anterior infarction, diabetes mellitus, shock, prior stroke and/or transient ischemic attack (TIA), prior heart failure, prior MI, and peripheral vascular disease (Table 5). Neither a prior history of CABG nor the subgroup of IRA culprit (native vs graft) were independently associated with outcome. To determine whether outcomes have changed over time, we stratified the cohort into an early (2000 to 2007) and contemporary (2008 to 2014) group and evaluated the cumulative incidence of death or

Table 1
Patient characteristics

Variable	CABG graft (n = 141)	CABG native (n = 155)	CABG total (n = 296)	p value*	Non-CABG STEMI reference (n = 2,916)	p value†
Age, (years±SD)	72.8 ±11.1	68.2±11.7	70.4±11.6	<0.001	64.3±13.9	<0.001
Men	100 (71%)	118 (76%)	218 (74%)	0.31	2,065 (71%)	0.31
Hypertension	120 (86%)	131 (85%)	251 (85%)	0.77	1,850 (68%)	<0.001
Dyslipidemia	119 (85%)	130 (84%)	249 (84%)	0.79	1,801 (69%)	<0.001
Diabetes Mellitus	51 (36%)	56 (36%)	107 (36%)	0.96	550 (19%)	<0.001
Body mass index, (kg/m^2±SD)	28.9 ± 5.4	29.9 ± 6.5	29.5±6.0	0.17	29.2±6.9	0.54
Current smoker	18 (13%)	34 (22%)	52 (18%)	0.04	973 (34%)	<0.001
Prior myocardial infarction	59 (42%)	68 (44%)	127 (43%)	0.77	456 (16%)	<0.001
Prior percutaneous coronary intervention	65 (46%)	60 (39%)	125 (42%)	0.18	425 (15%)	<0.001
Heart failure	35 (25%)	46 (30%)	81 (28%)	0.14	379 (13%)	<0.001
Recent coronary artery bypass grafting (≤30 days of index ST-elevation myocardial infarction)	3 (2%)	11 (7%)	14 (5%)	0.06	NA	
Peripheral vascular disease	32 (23%)	24 (16%)	56 (19%)	0.11	178 (6%)	<0.001
Stroke/transient ischemic attack	39 (28%)	22 (14%)	61 (21%)	0.004	223 (8%)	<0.001
Predominant symptom at presentation				0.22		0.83
Chest pain/dyspnea	128 (91%)	143 (92%)	271 (92%)		1,928 (93%)	
Arrhythmia	5 (4%)	9 (6%)	14 (5%)		96 (5%)	
Mod/severe renal insufficiency	10 (7%)	13 (8%)	23 (8%)	0.69	67 (2%)	<0.001
Dialysis	1 (<1%)	1 (<1%)	2 (<1%)	1.0	8 (1%)	
Chronic obstructive pulmonary disease	14 (10%)	21 (14%)	35 (12%)	0.35	234 (8%)	0.03
Peptic ulcer disease	12 (9%)	10 (7%)	22 (8%)	0.49	104 (4%)	0.001
Solid tumor or lymphoma/leukemia	20 (14%)	18 (12%)	38 (13%)	0.49	289 (10%)	0.12
Metastatic cancer	3 (2%)	6 (4%)	9 (3%)	0.51	40 (1%)	0.03
Ejection fraction ≤40%	18 (16%)	13 (10%)	31 (13%)	0.40	204 (7%)	<0.001
Cardiogenic shock	14 (10%)	31 (20%)	45 (15%)	0.02	356 (12%)	0.14

* comparisons between graft and native.
† comparisons between CABG total and STEMI reference groups.

Table 2
Procedural characteristics

Variable	CABG graft (n = 141)	CABG native (n = 155)	CABG total (n = 296)	p value*	Non-CABG STEMI reference (n = 2,916)	p value‡
Femoral access	140 (99%)	148 (96%)	288 (98%)	0.07	2,519 (88%)	<0.001
Number of coronary arteries with significant (≥70%) disease (±SD)	2.6 ± 0.7	2.3 ± 0.9	2.5±0.9	0.02	1.6 ± 0.7	<0.001
Number of vessels treated				0.02		0.05
1	104 (95%)	105 (86%)	209 (90%)		2,702 (94%)	
2	5 (5%)	17 (14%)	22 (10%)		160 (6%)	
Drug eluting stent	46 (43%)	68 (57%)	114 (50%)	0.04	1,635 (57%)	0.04
Embolic protection used	45 (32%)	0	51 (16%)	NA	NA	NA
Proximal protection	8 (18%)					
Distal protection	37 (82%)					
Pre-PCI TIMI flow				0.46		<0.001
0/1	77 (55%)	78 (50%)	155 (52%)		1,867 (64%)	
2/3	64 (45%)	77 (50%)	141 (48%)		1,049 (36%)	
Post-PCI TIMI flow				0.03		<0.001
0/1	21 (15%)	11 (7%)	32 (11%)		121 (4%)	
2/3	120 (85%)	144 (93%)	264 (89%)		2,795 (95%)	
Coronary territory undergoing percutaneous coronary intervention						
Left anterior descending	30 (21%)	33 (21%)	63 (21%)	0.98	1,278 (45%)	<0.001
Left circumflex	44 (31%)	52 (34%)	96 (33%)	0.70	467 (16%)	<0.001
Right coronary artery	72 (51%)	74 (48%)	146 (50%)	0.53	1,289 (45%)	0.13

TIMI, thrombolysis in myocardial infarction.
* comparisons between graft and native.
‡ comparisons between CABG total and STEMI reference groups.

Table 3
Discharge medications

Variable	CABG graft (n = 141)	CABG native (n = 155)	CABG total (n = 296)	p value*	Non-CABG STEMI reference (n = 2,916)	p value‡
Aspirin	129 (97%)	136 (90%)	265 (93%)	0.02	2,683 (94%)	0.43
P2Y12 inhibitor	122 (87%)	136 (88%)	258 (87%)	0.76	2,633 (90%)	0.09
Beta blockers	119 (90%)	136 (90%)	255 (90%)	0.87	2,603 (92%)	0.29
Statins/Lipid lowering therapy	124 (98%)	136 (93%)	260 (95%)	0.08	2,861 (97%)	0.13
Angiotensin converting-enzyme inhibitor/angiotensin receptor blocker	93 (66%)	108 (70%)	201 (68%)	0.49	2,218 (69%)	0.65

* comparisons between graft and native.
‡ comparisons between CABG total and STEMI reference groups.

Table 4
Clinical events of coronary artery bypass graft (CABG) ST-elevation myocardial infarction (STEMI) patients compared to non-CABG STEMI matched controls

Variable	CABG STEMI (n = 295)	Non-CABG STEMI controls (n = 1,180)	p Value
Retroperitoneal bleeding complication	<1%	<1%	0.69
Femoral bleeding complication	<1%	<1%	0.45
Hematoma	2%	4%	0.33
Gastrointestinal bleeding complication	2%	3%	0.42
Central nervous system bleeding complication	0%	0%	1.0
In-hospital death	5%	5%	1.0
In-hospital myocardial infarction	<1%	<1%	0.48
In-hospital target vessel revascularization	<1%	2%	0.22
In-hospital major adverse cardiac event	5%	6%	0.73
Post discharge death at 5 years	30%	25%	0.11
Post discharge myocardial infarction at 5 years	10%	6%	0.007
Post discharge target vessel revascularization at 5 years	17%	9%	<0.001
Post discharge major adverse cardiac event at 5 years	33%	23%	<0.001
Post discharge death at 10 years	42%	34%	0.004
Post discharge myocardial infarction at 10 years	11%	7%	0.021
Post discharge target vessel revascularization at 10 years	20%	10%	<0.001
Post discharge major adverse cardiac event at 10 years	42%	27%	<0.001

MACE at 5 years in CABG STEMI patients (Figure 4A) and in non-CABG STEMI patients (Figure 4B). No significant differences were noted among CABG STEMI patients, though higher rates of MI and TVR were observed more recently in non-CABG STEMI patients. Over the time period of the study, the frequency of demonstrating a graft culprit in the CABG STEMI cohort declined (52.8% between 2000 to 2007 and 42.9% between 2008 to 2014) (p = 0.09).

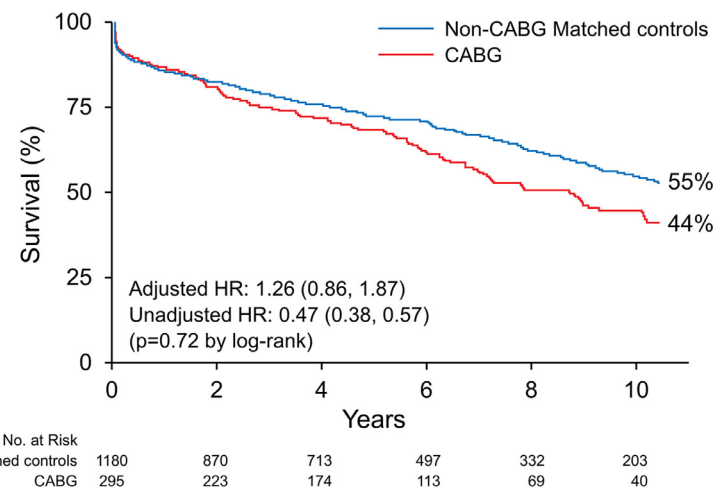

Figure 1. Long-term survival in CABG STEMI patients compared to non-CABG STEMI matched controls.

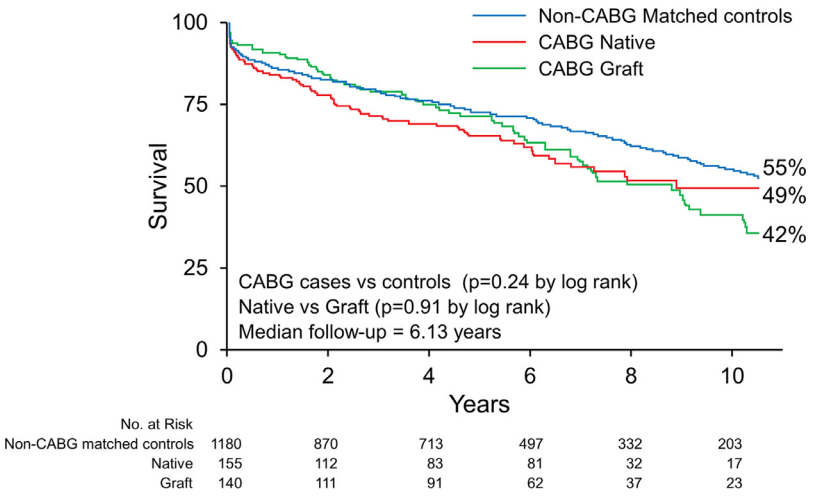

Figure 2. Long-term survival in CABG STEMI patients stratified by native versus graft culprit compared to non-CABG STEMI matched controls.

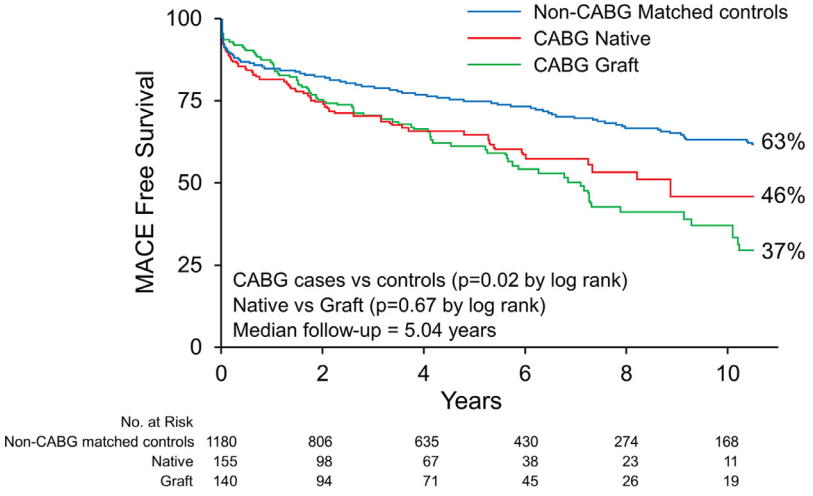

Figure 3. Long-term MACE-free survival in CABG STEMI patients stratified by native versus graft culprit compared to non-CABG STEMI matched controls. MACE = major adverse cardiac event.

Table 5
Multivariable analysis with predictors of death or major adverse cardiac event

Variables	Estimate	HR (95%CI)	p value
Coronary artery bypass graft ST-elevation myocardial infarction (vs non-coronary artery bypass graft ST-elevation myocardial infarction control)	0.007	1.01 (0.74-1.36)	0.96
Coronary artery bypass graft ST-elevation myocardial infarction with infarct-related artery as native (vs non-coronary artery bypass graft ST-elevation myocardial infarction control)	0.223	1.25 (0.99-1.58)	0.07
Coronary artery bypass graft ST-elevation myocardial infarction with infarct-related artery as graft (vs non-coronary artery bypass graft ST-elevation myocardial infarction control)	0.205	1.22(0.98-1.54)	0.08
Age (per 1 year increase)	0.035	1.04 (1.03-1.04)	<0.001
Anterior infarction	0.205	1.23 (1.03-1.46)	0.02
Diabetes Mellitus	0.330	1.39 (1.18-1.64)	<0.001
Cardiogenic shock	0.791	2.20 (1.83-2.66)	<0.001
Prior stroke/transient ischemic attack	0.375	1.45(1.21-1.76)	<0.001
Prior heart failure	0.651	1.92 (1.40-2.63)	<0.001
Prior myocardial infarction	0.273	1.31 (1.12-1.54)	<0.001
Peripheral vascular disease	0.376	1.46 (1.19-1.78)	<0.001

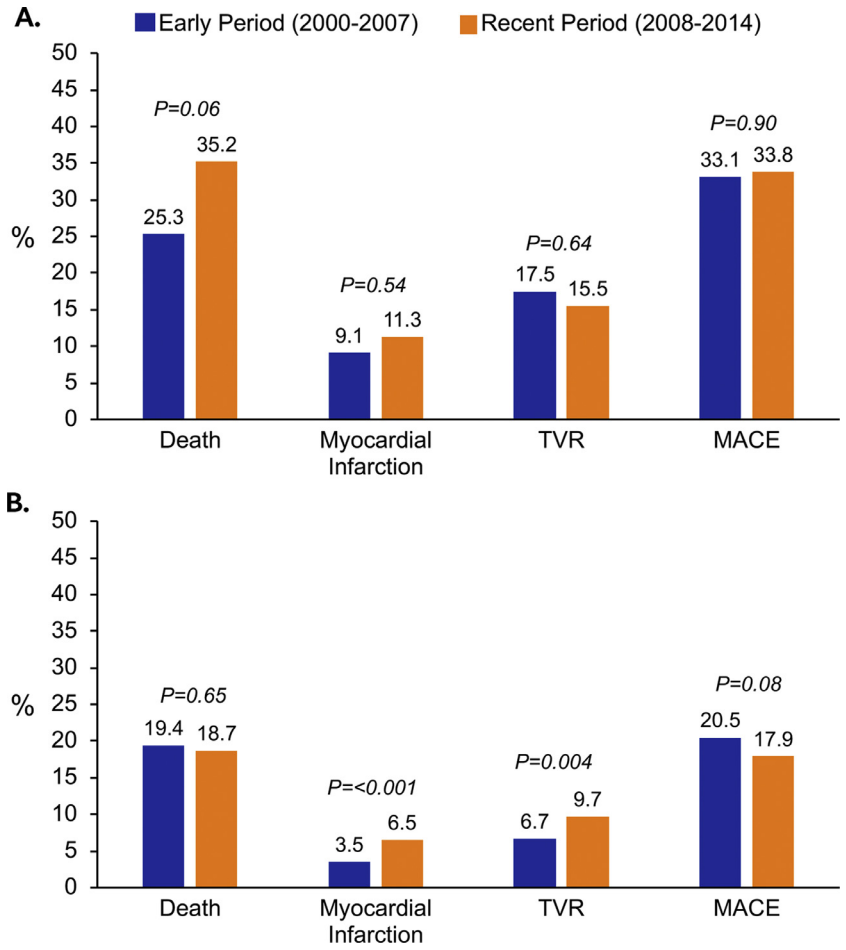

Figure 4. Temporal trends in 5-year events for early period versus recent period among (A) CABG STEMI patients and (B) non-CABG STEMI patients. MACE = major adverse cardiac event; TVR = target vessel revascularization.

Discussion

We identified that CABG STEMI patients are not uncommonly encountered, occurring in 9.2% of our STEMI population. This prevalence is slightly higher than the 2% to 7% reported from prior studies, with variation largely explained by population differences.[1,3,8–10] Few differences were identified at baseline between the native versus graft CABG STEMI cohort, though there were marked differences compared to non-CABG STEMI patients, underscoring greater baseline risk among those with prior CABG, as has been noted by others.[1,8,10] In-hospital events were similar between CABG versus non-CABG controls; however, crude rates of events were higher in CABG STEMI patients compared to matched non-CABG STEMI patients. Cumulative incidence curves demonstrated a trend towards lower survival among CABG STEMI patients as compared to propensity-matched non-CABG STEMI patients (44% vs 55%, respectively). MACE-free survival was significantly lower between cohorts and differed by culprit (culprit graft, 37%; culprit native, 46%; non-CABG STEMI matched patients, 63%) (p = 0.02). Temporal trends highlighted higher rates of clinical events among CABG STEMI patients as compared to non-CABG STEMI patients, with neither group showing substantial improvement in outcomes between time periods. This sobering finding in temporal trends highlights that further efforts towards risk reduction in high-risk MI patients are warranted.

We observed a near equal distribution of culprit native (52.4%) versus graft (47.6%) for CABG STEMI patients, similar to findings from others.[1,7,10] Kohl et al evaluated outcomes in 249 CABG STEMI patients and found no significant differences in early mortality but higher 5-year mortality when compared to non-CABG STEMI patients (24.9% vs 14.2%; $p < 0.001$), though data were unadjusted and a third of patients did not undergo primary PCI.[8] Iqbal et al evaluated outcomes of primary PCI in 2,658 patients with prior CABG compared with a propensity-matched non-CABG STEMI cohort.[10] Despite finding higher 30-day mortality in CABG STEMI, after adjustment, there were no significant differences between groups with respect to 1-year mortality and no independent effect of culprit native versus graft on outcome.[10] The study was limited with respect to details on graft territory, procedural variables (i.e., flow grades), and short-term follow up. An early study from the second primary angioplasty in myocardial infarction trial found higher in-hospital mortality in CABG patients (n = 58) as compared to reference non-CABG patients (9.4% vs 2.6%; p = 0.02), which also persisted at

6-months.[7] Nikolsky et al examined the CABG STEMI cohort (n = 105) from the Harmonizing Outcomes with Revascularization and Stents in Acute Myocardial Infarction trial and showed lower rates of primary PCI, flow grades, and ST-segment resolution as compared to non-CABG STEMI patients.[9] MACE or mortality was not different at 30-days between groups; however, MACE was higher in CABG STEMI patients compared to non-CABG STEMI patients at 3 years (36.4% vs 21.4%), driven primarily by TVR and stroke.[9] SVG PCI as compared to PCI of a native culprit in CABG patients in Harmonizing Outcomes with Revascularization and Stents in Acute Myocardial Infarction was associated with higher rates of MACE at 3 years; however, neither prior CABG nor culprit (graft vs native) were independent predictors of mortality. Primary PCI in CABG STEMI patients intersects higher patient risk with procedural risk and more technical challenges,[13] with recognition that despite smaller infarctions in SVG culprits and lower rates of anterior infarctions,[1,8,9] these patients remain at high risk for events after their index procedure.

In our study, factors strongly associated with death or MACE were age, anterior infarction, diabetes mellitus, shock, prior stroke and/or TIA, prior heart failure, prior MI, and peripheral artery disease, but not culprit type (graft vs native). We illustrated that CABG STEMI patients as compared to a reference non-CABG STEMI matched cohort have significantly lower MACE-free survival at 10 years. Secondly, we reported high rates of guideline directed therapy at discharge after STEMI in CABG patients. Although there are limited data from trials guiding use of secondary prevention therapies after CABG,[14] use of antiplatelet therapy, statins, and beta-blockers along with risk reduction for diabetes control, smoking cessation, and exercise after CABG are recommended,[14,15] though secondary prevention medication persistence may decrease over time.[16] Thirdly, all patients in the present analysis underwent primary PCI, with procedural data on use and type of embolic protection devices, pre- and postflow grades, and adjustment for infarct location being reported. Finally, despite primary PCI for all CABG patients with STEMI in our analysis and similar in-hospital event rates, we show that these patients remain at increased risk for late events, which has not materially changed over time. The reason for the lack of improvement in death or MACE among CABG STEMI patients in more recent years in our study is unclear, though it may reflect higher comorbidity burden or higher-risk presentations of patients undergoing primary PCI in the contemporary era.

Our study has limitations that deserve mention. All patients were treated by primary PCI, thus comparisons to patients who met criteria for STEMI and did not undergo PCI or were medically managed may represent potential selection bias. Drug eluting stent use for CABG graft patients was relatively low in our study (43%), however, recent data has questioned any benefit over bare metal stents for SVG PCI.[17] Our definition for preprocedural shock in this study differs from other more commonly used definitions, but was used to remain consistent with previously published studies using the same data elements.[18,19] Although a propensity matched cohort of non-CABG STEMI patients was used for comparison purposes, the higher baseline cardiovascular risk profile of CABG patients persisted resulting in imperfect adjustment. Given the recognized differences in baseline cardiovascular risk between CABG STEMI and non-CABG STEMI populations, particularly a history of previous MI, there are also likely unmeasured confounders that also factor into important group differences. Finally, a small proportion of patients that are not followed by our health system after STEMI may subsequently present to nonaffiliated facilities. Outcome assessment performed annually by data abstractors may be influenced by recall bias among subjects.

From a clinical perspective, our work highlights the not infrequent presentation of patients with prior CABG and acute STEMI. Greater baseline clinical risk and lower procedural success are often present, though in-hospital events are generally similar to non-CABG STEMI patients. Although crude long-term event rates and 5- and 10-years post discharge remain higher among CABG STEMI patients, death or MACE-free survival is not significantly different when compared to non-CABG STEMI (HR 1.01, 95%CI 0.74 to 1.36; p = 0.96) after adjusting for important baseline factors and infarct location. This observation may be due to a trade-off between fewer anterior infarctions in CABG STEMI but in the context of greater comorbidity burden in this subset of patients. When analyzed by culprit IRA, there was no significant difference in survival among CABG STEMI patients. Clinical comorbidities carried stronger independent associations with death or MACE than did CABG status or culprit IRA among CABG patients.

Authors' Contributions

S. Michael Gharacholou MD MSc: Conceptualization, Investigation, Methodology, Project administration, Resources, Supervision, Validation, Writing-Original Draft, Writing-Review and Editing, Visualization, Funding acquisition; Freddy Del-Carpio Munoz MD MSc: Investigation, Methodology, Validation, Writing-Review and Editing; Arashk Motiei MD: Investigation, Validation, Writing-Review and Editing; Gurpreet S. Sandhu MD PhD: Investigation, Validation, Writing-Review and Editing, Supervision; Gregory W. Barsness MD: Validation, Writing-Review and Editing, Supervision; Rajiv Gulati MD PhD: Validation, Writing-Review and Editing, Supervision; R. Scott Wright, MD: Validation, Writing-Review and Editing, Supervision; Patricia A. Pellikka MD: Validation, Writing-Review and Editing, Supervision; Bradley Lewis MS: Methodology, Validation, Investigation, Resources, Writing- Review and Editing, Visualization; Matthew P. Johnson MS: Methodology, Validation, Investigation, Resources, Writing- Review and Editing, Visualization; Gary E. Lane MD: Validation, Writing-Review and Editing; Peter M. Pollak: Validation, Writing-Review and Editing; Dilip P. Pillai: Validation, Writing-Review and Editing; Abdallah El Sabbagh: Validation, Writing-Review and Editing; Timir K. Paul MD PhD: Validation, Writing-Review and Editing; Si M. Pham MD: Validation, Writing-Review and Editing; Mandeep Singh MD: Investigation, Validation, Writing-Review and Editing, Supervision, Project administration.

Appendix

Appendix Table 1.

Baseline characteristic comparison of coronary artery bypass graft (CABG) ST-elevation myocardial infarction (STEMI) cohort and matched non-CABG STEMI cohort

	CABG	Non-CABG	p value
Age (years±SD)	70.3±11.6	69.8±12.4	0.49
Men	218 (74%)	849 (72%)	0.50
Hypertension	251 (85%)	997 (85%)	0.78
Dyslipidemia	249 (84%)	990 (84%)	0.82
Diabetes mellitus	107 (36%)	375 (32%)	0.14
Body mass index (kg/m2±SD)	29.5±6.0	29.6±8.3	0.72
Prior myocardial infarction	127 (43%)	366 (31%)	<0.001
Prior percutaneous coronary intervention	125 (42%)	362 (31%)	<0.001
Heart failure	81 (28%)	248 (21%)	0.008
Peripheral vascular disease	56 (19%)	146 (12%)	0.003
Stroke/transient ischemic attack	61 (21%)	166 (14%)	0.005
Moderate to severe renal insufficiency	23 (8%)	50 (4%)	0.02
Peptic ulcer disease	22 (8%)	71 (6%)	0.37

Disclosures

The authors have no conflicts of interest to disclose.

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