Timing of coronary artery bypass grafting after myocardial infarction influences late survival

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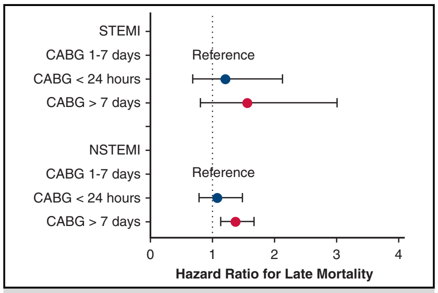
ABSTRACT

Objectives: The role of timing of coronary artery bypass grafting after acute myocardial infarction on early and late outcomes remains uncertain.

Methods: We reviewed 1631 consecutive adult patients who underwent isolated coronary artery bypass grafting with information on timing of acute myocardial infarction. Early and late mortality were compared between patients receiving coronary artery bypass grafting within 24 hours after acute myocardial infarction, between 1 and 7 days after acute myocardial infarction, and more than 7 days after acute myocardial infarction. Sensitivity analyses were performed in subgroups of patients with ST-segment elevation myocardial infarction or non–ST-segment elevation myocardial infarction, and other high-risk groups.

Results: A total of 124 patients (5.7%) underwent coronary artery bypass grafting within 24 hours, 972 patients (51.2%) received coronary artery bypass grafting between 1 and 7 days after acute myocardial infarction, and 535 patients (43.2%) underwent coronary artery bypass grafting more than 7 days after acute myocardial infarction. Overall operative mortality was 2.7% with comparable adjusted early mortality among 3 groups. Over a median follow-up of 13.5 years (interquartile range, 8.9-17.1), compared with patients receiving coronary artery bypass grafting between 1 and 7 days after acute myocardial infarction, those receiving coronary artery bypass grafting at 7 days had greater adjusted risk for late overall mortality (hazard ratio, 1.39, 95% CI, 1.16-1.67; $P < .001$), whereas those receiving coronary artery bypass grafting within 24 hours had comparable risk of late overall mortality (hazard ratio, 1.12, 95% CI, 0.86-1.47; $P = .39$). Timing of coronary artery bypass grafting was associated with late mortality in patients with non–ST-segment elevation myocardial infarction (patients receiving coronary artery bypass grafting at >7 days had a higher risk of late mortality [hazard ratio, 1.38, 95% CI, 1.14-1.67, $P < .001$] compared with those receiving coronary artery bypass grafting between 1 and 7 days), but not in patients with ST-segment elevation myocardial infarction.

Conclusions: Early revascularization through coronary artery bypass grafting within 7 days during the same hospitalization appears beneficial, especially for patients presenting with non–ST-segment elevation myocardial infarction. (JTCVS Open 2024;20:40-8)



Long-term mortality risk after CABG in patients with STEMI and NSTEMI.

CENTRAL MESSAGE

Delaying CABG beyond 7 days after AMI appears to be associated with poor survival. Early surgical revascularization during the same hospitalization may be considered, especially for those with NSTEMI.

PERSPECTIVE

Surgical revascularization can be performed safely within 24 hours after AMI. However, delaying CABG beyond 7 days after AMI was associated with poor late survival. This effect was pronounced in elderly patients, those presenting with NSTEMI, and diabetic patients.

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Contemporary management of acute myocardial infarction (AMI) primarily includes percutaneous coronary intervention (PCI) or thrombolytic therapy, especially for those presenting with ST-segment elevation myocardial infarction (STEMI).[1] Significant improvement in outcomes associated with percutaneous revascularization has resulted in a decline in the use of coronary artery bypass grafting (CABG) in recent years.[2-4] Analyses of large national

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Abbreviations and Acronyms

AMI = acute myocardial infarction
CABG = coronary artery bypass grafting
HR = hazard ratio
IQR = interquartile range
NSTEMI = non–ST-segment elevation myocardial infarction
PCI = percutaneous coronary intervention
STEMI = ST-segment elevation myocardial infarction

databases identified that only approximately 10% of patients with AMI undergo CABG.[4,5] However, surgical revascularization remains the mainstay for multivessel or left main disease and in those with failed percutaneous revascularization.[6,7] Refinement in patient selection, perioperative management, and surgical techniques has resulted in a steady decline in operative mortality associated with CABG in patients with AMI.[3,4] However, there remains uncertainty with regard to the timing of CABG surgery after AMI.[8] Consensus recommendations suggest delaying CABG in patients with STEMI because of evidence of higher operative mortality, although a few other studies have shown that the timing of CABG was not associated with mortality.[9-12] For non–ST segment elevation myocardial infarction (NSTEMI), although some studies reported outcomes were independent of timing of surgery, others identified higher mortality with same-day CABG and greater resource use with delayed CABG.[5,11,13,14] Given this uncertainty and the lack of data on whether timing of CABG has differential impact in high-risk groups of AMI, we reviewed our institutional experience to assess the role of timing of CABG on early and late outcomes after AMI and in high-risk subgroups of these patients.

MATERIAL AND METHODS

We identified 6077 consecutive adult patients undergoing isolated CABG at our institution between January 2003 and December 2016. Among these, only patients with a validated diagnosis of AMI and with information on timing between AMI and CABG, and those undergoing CABG within 1 year from diagnosis of AMI formed the study cohort (n = 1631). Patients with missing or uncertain information on timing of AMI and those with an AMI more than 1 year before surgery were excluded. Presence of AMI as a diagnosis in the clinician/surgeon note and presence of an administrative billing code for STEMI and NSTEMI (ICD-9CM 410.x, ICD-10CM I21.x, I22.x) were required to be considered as a validated diagnosis of AMI. All included patients provided authorization for use of their medical records for research purposes, and study approval was received from the Mayo Clinic Institutional Review Board (No: 19006657, approved on 7/30/2019).

Baseline variables including demographics, comorbid conditions, and operative history were primarily obtained from a prospectively maintained institutional cardiovascular surgery database. Information on characteristics of AMI, time between presentation of AMI and CABG, operative characteristics, and early postoperative outcomes were captured through review of angiography reports, echocardiography reports, surgical notes, and medical records, and from the institutional database. Late survival status was mainly ascertained using Lexis Nexis Accurint along with death certificates, autopsy reports, and obituary notices from patient records.[15]

Statistical Analysis

The study cohort was stratified based on time elapsed between most recent AMI presentation and CABG surgery into 3 groups: patients receiving CABG within 24 hours after AMI, between 1 and 7 days after AMI, and more than 7 days after AMI. Baseline information is summarized as numbers (percentages) for categorical variables and as median (interquartile range [IQR]) for continuous variables. Between-group comparisons were performed using Chi-squared or Fisher's exact test for categorical data and Kruskal–Wallis test or analysis of variance test for continuous data. Association between timing of CABG and operative mortality was estimated using a logistic regression adjusting for patient demographics, comorbid conditions, cardiogenic shock, coronary disease characteristics, and operative characteristics (Table E1). Late survival was estimated and compared using Kaplan–Meier analysis and log-rank test. Comparison of late survival between groups was performed using a Cox proportional hazards regression model fitted with covariates chosen a priori based on clinical relevance or known association with outcome (death). Covariates included were age, sex, body mass index, diabetes, hypertension, chronic lung disease, peripheral vascular disease, cerebrovascular disease, renal failure requiring dialysis, New York Heart Association function class, left ventricular ejection fraction, preoperative cardiogenic shock, prior cardiac surgery, prior CABG, prior PCI, type of AMI, triple-vessel disease, left main disease, number of diseased vessels, and operative status. We also performed a sensitivity analysis in subgroups of patients with STEMI and NSTEMI to determine if the timing of CABG had a differential impact based on the type of AMI.

RESULTS

The median age of the study cohort was 68 (IQR, 59-76) years, and 385 (23.6%) were female. A total of 286 patients (17.5%) underwent CABG after STEMI, and the remaining 1345 patients (82.5%) presented with NSTEMI. Among these, 124 patients (5.7%) underwent CABG within 24 hours, 972 patients (51.2%) received CABG between 1 and 7 days after AMI, and 535 patients (43.2%) underwent CABG more than 7 days after AMI. The median time between AMI diagnosis and CABG was 18 days (IQR, 9-48 days) for patients revascularized beyond 7 days. Differences in baseline characteristics among the 3 groups are listed in Table 1. Patients undergoing CABG within 24 hours after AMI had a higher proportion of STEMI presentations, severe functional limitation (New York Heart Association functional class III or more), and preoperative cardiogenic shock. Prior CABG and prior PCI were more common in the group receiving CABG 7 days after AMI. The number of diseased coronary vessels and presence of triple-vessel disease were comparable among the 3 groups; however, left main disease was more frequent in patients undergoing CABG within 24 hours (Table 1).

Early Outcomes

Overall operative mortality was 2.7% with a significantly higher unadjusted mortality for patients undergoing CABG within 24 hours (8.9% vs 1.7% vs 3.0%) when compared

TABLE 1. Preoperative characteristics of patients undergoing isolated coronary artery bypass grafting for acute myocardial infarction

Characteristic	CABG within 24 hours N = 124	CABG between 1-7 days N = 972	CABG after 7 days N = 535	*P*
Age, y	69.5 (58.0-77.0)	68.0 (59.0-76.0)	68.0 (60.0-75.0)	.38
Female sex	29 (23.4%)	226 (23.3%)	130 (24.3%)	.89
Body mass index, kg/m^2	28.1 (26.0-32.3)	29.8 (26.6-33.8)	28.7 (25.7-32.6)	<.001
Type of AMI				<.001
STEMI	45 (36.3%)	140 (14.4%)	101 (18.9%)	
NSTEMI	79 (63.7%)	832 (85.6%)	434 (81.1%)	
NYHA class ≥3	107 (86.3%)	804 (82.7%)	330 (61.7%)	<.001
LV ejection fraction, %	47.0 (35.0-60.0)	53.0 (43.0-60.0)	50.0 (37.8-60.0)	<.001
Hypertension	99 (79.8%)	811 (83.4%)	465 (86.9%)	.07
Diabetes	37 (29.8%)	348 (35.8%)	220 (41.1%)	.03
Chronic lung disease	14 (11.3%)	89 (9.2%)	83 (15.5%)	<.001
Peripheral vascular disease	25 (20.2%)	143 (14.7%)	96 (17.9%)	.12
Cerebrovascular disease	19 (15.3%)	163 (16.8%)	110 (20.6%)	.13
Dialysis	1 (0.8%)	16 (1.6%)	19 (3.6%)	.03
Previous CABG	5 (4.0%)	27 (2.8%)	21 (3.9%)	.43
Prior PCI	26 (21.0%)	204 (21.0%)	238 (44.5%)	<.001
Prior cardiac surgery	5 (4.0%)	30 (3.1%)	23 (4.3%)	.46
Preoperative cardiogenic shock	27 (22.0%)	19 (2.0%)	12 (2.2%)	<.001
3-vessel disease	102 (82.3%)	800 (82.3%)	435 (81.3%)	.88
No. of diseased vessels	4.0 (4.0-4.0)	4.0 (4.0-4.0)	4.0 (4.0-4.0)	.91
Left main disease	67 (54.0%)	368 (37.9%)	181 (33.8%)	<.001

Represented as mean ± SD or median (IQR) and number (percentage). *CABG*, Coronary artery bypass grafting; *AMI*, acute myocardial infarction; *STEMI*, ST-segment elevation myocardial infarction; *NSTEMI*, non–ST-segment elevation myocardial infarction; *NYHA*, New York Heart Association; *LV*, left ventricle; *PCI*, percutaneous coronary intervention.

with CABG between 1 and 7 days and CABG more than 7 days groups ($P < .001$). However, after adjusting for patient demographics, comorbidities, disease, and operative characteristics, we identified comparable adjusted early mortality among all 3 groups (Table E1).

Postoperative atrial fibrillation was identified in 521 patients (31.9%), and stroke or transient ischemic episode was seen in 34 patients (2.1%). Re-exploration to address bleeding was performed in 51 patients (3.1%), and in 8 patients (0.5%) reoperation for graft replacement was performed. Early postoperative outcomes were comparable among all 3 groups (Table 2).

Late Outcomes

Over a median follow-up of 13.5 years (IQR, 8.9-17.1), there were 887 deaths. Overall survival at 5, 10, and 15 years was 79.2%, 56.8%, and 35.9%, respectively. Unadjusted survival estimated using Kaplan–Meier analysis revealed significant differences in the median survival time of the 3 groups (log-rank $P = .008$, Figure 1). In adjusted Cox regression analysis with patients receiving CABG between 1 and 7 days after AMI as reference (Table 3), those receiving CABG after 7 days had significantly greater risk for late mortality (hazard ratio [HR], 1.39, 95% CI, 1.16-1.67; $P < .001$), whereas those receiving CABG within 24 hours had comparable risk of late mortality (HR, 1.12, 95% CI, 0.86-1.47; $P = .39$).

In subgroup analysis of patients with STEMI, timing of CABG was not associated with late mortality (Table 4). However, among those with NSTEMI, similar to the primary findings, patients undergoing CABG after 7 days had a higher risk of late mortality (HR, 1.38, 95% CI, 1.14-1.67, $P < .001$, Figure 2) compared with those receiving CABG between 1 and 7 days. A higher risk of late mortality with CABG after 7 days was also identified in subgroups of female patients (HR, 1.39, 95% CI, 1.02-1.91, $P = .039$), male patients (HR, 1.40, 95% CI, 1.12-1.75, $P = .03$), patients with diabetes (HR, 1.43, 95% CI, 1.09-1.89, $P = .01$), and elderly patients (age ≥70 years) (HR, 1.41, 95% CI, 1.11-1.79, $P = .005$) (Table 4).

DISCUSSION

In this large single-center analysis of patients undergoing CABG after AMI, we identified that CABG can be

TABLE 2. Operative characteristics and early outcomes of patients undergoing isolated coronary artery bypass grafting for acute myocardial infarction

Characteristic	CABG within 24 hours N = 124	CABG between 1-7 days N = 972	CABG after 7 days N = 535	P
Operative characteristics				
Status				<.001
Elective	8 (6.5%)	70 (7.2%)	333 (62.2%)	
Urgent	67 (54.0%)	876 (90.1%)	197 (36.8%)	
Emergency	49 (39.5%)	26 (2.7%)	5 (0.9%)	
Perioperative IABP	75 (60.5%)	153 (15.7%)	52 (9.7%)	<.001
Perioperative ECMO	5 (4.0%)	6 (0.6%)	4 (0.7%)	.009
Cardiopulmonary bypass time	76.0 (62.0-97.0)	85.0 (67.0-104.0)	82.0 (63.0-102.0)	.03
Crossclamp time	49.0 (38.0-63.0)	58.0 (45.0-72.0)	56.0 (41.0-71.0)	<.001
Early outcomes				
Operative mortality	11 (8.9%)	17 (1.7%)	16 (3.0%)	<.001
Postoperative stroke/ transient ischemic attack	6 (4.8%)	18 (1.9%)	10 (1.9%)	.09
Readmission within 30 d	6 (5.8%)	64 (8.2%)	58 (12.7%)	.02
Postoperative atrial fibrillation	46 (37.1%)	309 (31.8%)	166 (31.0%)	.42
Reoperation for bleeding	5 (4.0%)	27 (2.8%)	19 (3.6%)	.52
Reoperation for graft replacement	1 (0.8%)	4 (0.4%)	2 (0.4%)	.011

Represented as mean ± SD or median (IQR) and number (percentage). *CABG*, Coronary artery bypass grafting; *IABP*, intra-aortic balloon pump; *ECMO*, extracorporeal membrane oxygenation.

performed safely within 24 hours after AMI with adjusted operative mortality comparable to those undergoing CABG between 1 and 7 days and after 7 days. We identified that delaying CABG until after 7 days from AMI was associated with poor long-term survival when compared with CABG before 7 days. This greater risk of mortality with delayed CABG was apparent in elderly patients, patients with NSTEMI, and diabetic patients.

Considerations while determining the timing of CABG after AMI include whether to operate early on a high-risk hemodynamically unstable patient without sufficient time to wean off antithrombotic therapy or delay surgery until

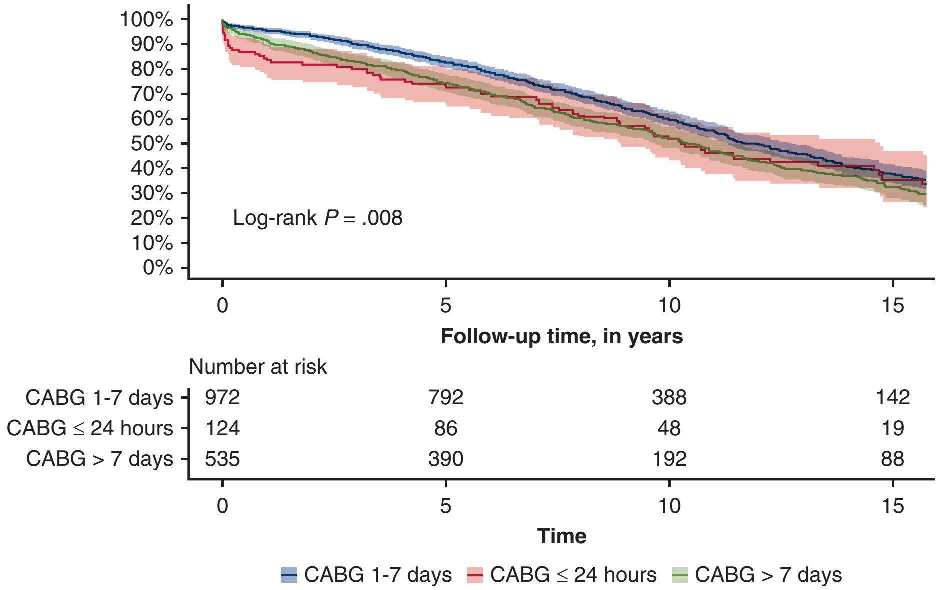

FIGURE 1. Kaplan–Meier estimate of survival comparing patients undergoing CABG within 24 hours, between 1 and 7 days, and more than 7 days after AMI. *CABG*, Coronary artery bypass grafting; *AMI*, acute myocardial infarction.

TABLE 3. Cox proportional hazards regression for late mortality in patients undergoing coronary artery bypass grafting after acute myocardial infarction

Characteristic	HR (95% CI)	*P*
CABG timing		
<24 h	1.12 (0.86-1.47)	.39
1-7 d	Reference	
>7 d	1.39 (1.16-1.67)	<.001
Age		<.001
<60 y	Reference	
60-70 y	1.90 (1.53-2.37)	
>70 y	4.28 (3.47-5.28)	
Female sex	0.99 (0.86-1.16)	.99
Body mass index, kg/m^2	1.00 (0.99-1.01)	.78
Hypertension	1.23 (0.98-1.54)	.07
Diabetes	1.49 (1.30-1.72)	<.001
Chronic lung disease	1.86 (1.55-2.24)	<.001
Peripheral vascular disease	1.45 (1.22-1.72)	<.001
Cerebrovascular disease	1.57 (1.33-1.85)	<.001
Dialysis	2.88 (1.99-4.16)	<.001
Preoperative cardiogenic shock	1.14 (0.80-1.60)	.47
NYHA class ≥3	1.40 (1.15-1.71)	.04
Prior PCI	1.14 (0.98-1.34)	.10
Prior CABG	1.94 (1.40-2.68)	<.001
3-vessel disease	1.27 (0.65-2.49)	.48
No. of diseased vessels	0.99 (0.54-1.80)	.98
Left main disease	1.10 (0.95-1.27)	.19
LVEF ≤45%	1.76 (1.53-2.04)	<.001
Type of AMI		
STEMI	Reference	
NSTEMI	1.33 (1.09-1.63)	.01
Status		
Elective	Reference	
Urgent/emergency	1.21 (0.99-1.46)	.05

HR, Hazard ratio; *CABG*, coronary artery bypass grafting; *NYHA*, New York Heart Association; *PCI*, percutaneous coronary intervention; *LVEF*, left ventricular ejection fraction; *AMI*, acute myocardial infarction; *STEMI*, ST-segment elevation myocardial infarction; *NSTEMI*, non–ST-segment elevation myocardial infarction.

recovery of left ventricular function and run the risk of further ischemic insults and myocardial damage. Further, management strategy varies depending on the type of AMI. Most early studies investigating the optimal timing of CABG reported higher mortality and complications with early intervention,[16-20] and subsequently guidelines recommended delaying CABG in patients without ongoing ischemia to reduce mortality risk.[6,9] In contrast to the above reports, over the last decade, an increasing number of reports have shown that timing of CABG has no association with outcomes after AMI.[5,11,14,21,22] A few other studies reported significantly higher resource use with delaying surgery without any perceived outcome benefit.[5,13] The varying time periods for categorizing early and delayed intervention, and differences in AMI characteristics in all these studies have resulted in such conflicting reports. Further, there have been several advances in management of AMI over the years, and these may have contributed to the conflicting findings between older and contemporary reports.[1] For the present study, given that CABG performed within 1 day after AMI was associated with high mortality risk in many prior studies, and that guidelines suggest waiting between 3 and 7 days in STEMI cases for stabilization and in NSTEMI cases for weaning of

TABLE 4. Sensitivity analysis of impact of timing of coronary artery bypass grafting after acute myocardial infarction in various high-risk subgroups of patients

Subgroup	HR (95% CI)	P
STEMI		
CABG timing		
<24 h	1.21 (0.68-2.13)	.52
1-7 d	Reference	
>7 d	1.56 (0.81-3.01)	.19
NSTEMI		
CABG timing		
<24 h	1.08 (0.79-1.48)	.64
1-7 d	Reference	
>7 d	1.38 (1.14-1.67)	<.001
Female		
CABG timing		
<24 h	0.71 (0.40-1.26)	.24
1-7 d	Reference	
>7 d	1.39 (1.02-1.91)	.039
Male		
CABG timing		
<24 h	1.27 (0.92-1.75)	.15
1-7 d	Reference	
>7 d	1.40 (1.12-1.75)	.003
Age <70 y		
CABG timing		
<24 h	0.99 (0.63-1.56)	.98
1-7 d	Reference	
>7 d	1.23 (0.93-1.64)	.15
Age ≥70 y		
CABG timing		
<24 h	1.23 (0.88-1.72)	.23
1-7 d	Reference	
>7 d	1.41 (1.11-1.79)	.005
Diabetes		
CABG timing		
<24 h	1.13 (0.72-1.77)	.59
1-7 d	Reference	
>7 d	1.43 (1.09-1.89)	.011

HR, Hazard ratio; *STEMI*, ST-segment elevation myocardial infarction; *CABG*, coronary artery bypass grafting; *NSTEMI*, non–ST-segment elevation myocardial infarction.

anticoagulants for elective CABG, we chose less than 1 day, 1 to 7 days, and more than 7 days as groups of interest.

Unlike in prior reports,[10,13,16] we did not find higher mortality risk for patients undergoing CABG within 24 hours after AMI compared with those undergoing late CABG. In contemporary literature, Bianco and colleagues[11] reported a similarly comparable risk of mortality and readmissions between patients undergoing CABG within 24 hours and after 24 hours. On the contrary, Nichols and colleagues[10] in their evaluation of large registry data reported higher mortality for those undergoing CABG within 24 hours. Higher mortality after CABG within 24 hours was reported in another recent database analysis.[13] These differences could be related to institutional practices, patient selection, and patient characteristics. In most studies, higher mortality risk with early CABG was especially apparent in the STEMI subgroup.[12,17] However, we did not find such an association even when stratifying into STEMI and NSTEMI subgroups.

We identified that delaying CABG beyond 7 days was associated with increased long-term mortality. In subgroup analysis, no such difference was identified for patients with STEMI. This is understandable because it is highly likely that any patient with STEMI receiving CABG after 7 days underwent a PCI for the culprit lesion halting ongoing ischemia, with CABG reserved for addressing other coronary vessels after stabilization. However, for patients with NSTEMI, our results suggest that delaying CABG beyond 7 days could result in the ongoing ischemia contributing to further ischemic insult and myocardial damage that is unlikely to recover completely even after surgery, resulting in poor late outcomes. Additionally, patients presenting with NSTEMI are typically older patients in whom complete myocardial recovery is unlikely, and therefore, minimizing myocardial damage through early revascularization may improve survival. Few contemporary studies have reported long-term outcomes of patients with NSTEMI based on the timing of CABG.[11,14] Davierwala and colleagues[14] reported comparable long-term outcomes with early and late surgical revascularization for NSTEMI, although the delayed CABG group in their study included those undergoing CABG after 3 days.[14] Bianco and colleagues[11] reported comparable late outcomes in patients undergoing CABG within 24 hours and after 24 hours for both NSTEMI and STEMI subgroups.

Outcomes after CABG are known to be influenced by sex, age, diabetes, lung and renal disease, among others.[17,23-25] However, it is unclear whether timing of CABG has a differential impact on outcomes in these high-risk groups. Results of these subgroup analysis were largely comparable to the primary findings. Outcomes of patients undergoing CABG within 24 hours in these subgroups were comparable to those undergoing CABG between 1 and 7 days after AMI. However, in female patients and those with diabetes, delayed CABG (after 7 days from AMI) was associated with increased risk of mortality.

Study Limitations

The present analysis has limitations associated with a retrospective design. There is also a potential for selection bias because our practice represents a tertiary referral center and may attract particularly complex patients. It is possible that some patients were not offered surgery after AMI or died during the waiting period between diagnosis and surgery. We do not have information on those patients who did not present for surgery. Further, the number of different

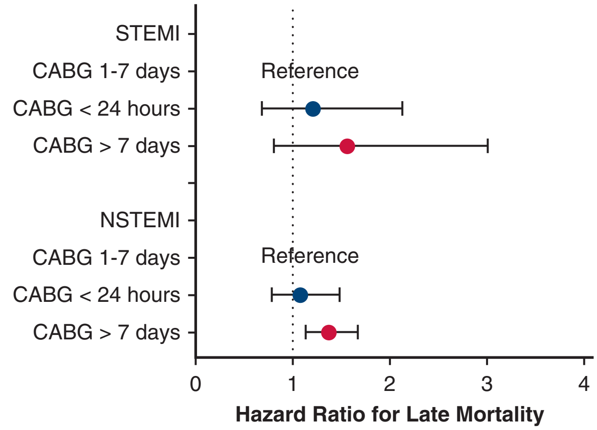

FIGURE 2. Forest plot showing long-term mortality risk in STEMI and NSTEMI cohorts based on timing of CABG. *STEMI*, ST-Segment elevation myocardial infarction; *NSTEMI*, non–ST-segment elevation myocardial infarction; *CABG*, coronary artery bypass grafting.

surgeons performing operations and individual preferences may have impacted the observed results. We did not have information on time elapsed between prior revascularization and current CABG surgery in patients with a remote history of PCI or CABG. Information on cause of death was available in only a small subset of patients (n = 235); thus, we were unable to evaluate the association of timing of CABG with cardiovascular mortality. Despite adjusting for several potential confounders, there may be other unmeasured variables that may influence outcomes. Last, our analysis focused only on survival and did not evaluate impact of timing of CABG on readmissions or need for repeat revascularization.

CONCLUSIONS

Patients undergoing CABG within 7 days after AMI had better survival compared with those receiving CABG after 7 days. Early revascularization through CABG during the same hospitalization appears beneficial, especially for elderly patients, patients presenting with NSTEMI, and diabetic patients. Reducing the risk of progression of AMI with subsequent ischemic insults and limiting ventricular remodeling by early intervention appear to improve recovery of left ventricular function, resulting in comparatively better outcomes.

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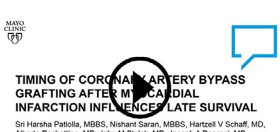

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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Key Words: acute myocardial infarction, coronary artery bypass grafting, survival, timing

TABLE E1. Multivariable logistic regression analysis for operative mortality in patients undergoing coronary artery bypass grafting after acute myocardial infarction

Characteristic	Odds ratio	95% CI		P
		Lower limit	Upper limit	
CABG timing				
1-7 d		Reference		
≤24 h	3.15	0.96	10.30	.06
>7 d	2.48	0.94	6.53	.07
Age, y	1.06	1.02	1.10	.01
Female sex	0.38	0.12	1.20	.10
Body mass index, kg/m^2	0.99	0.92	1.06	.78
Hypertension	6.76	0.98	46.56	.05
Diabetes	0.69	0.28	1.70	.42
Chronic lung disease	2.96	1.18	7.39	.02
Peripheral vascular disease	1.37	0.53	3.54	.51
Cerebrovascular disease	0.82	0.32	2.13	.68
Dialysis	2.13	0.30	14.99	.45
Prior PCI	1.32	0.53	3.26	.55
Preoperative cardiogenic shock	2.50	0.69	9.02	.16
Prior cardiac surgery	2.26	0.45	11.29	.32
LVEF ≤45%	3.16	1.32	7.55	.01
NYHA class ≥3	1.12	0.31	4.00	.87
Left main disease	0.25	0.10	0.62	.003
Urgent/emergency	6.01	1.28	28.23	.02
Intra-aortic balloon pump	3.72	1.47	9.45	.01
Extracorporeal membrane oxygenation	19.40	2.67	140.88	.00
Cardiopulmonary bypass time	1.03	1.02	1.04	<.001
Crossclamp time	0.97	0.95	0.99	.003
Type of AMI				
STEMI		Reference		
NSTEMI	2.33	0.74	7.35	.15

CABG, Coronary artery bypass grafting; *PCI*, percutaneous coronary intervention; *LVEF*, left ventricular ejection fraction; *NYHA*, New York Heart Association; *AMI*, acute myocardial infarction; *STEMI*, ST-segment elevation myocardial infarction; *NSTEMI*, non–ST-segment elevation myocardial infarction.