Long-term outcomes and comparison after conventional coronary artery bypass grafting for left main disease between patients classified as percutaneous coronary intervention recommendation classes II and III

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Abstract

OBJECTIVES: We retrospectively analysed long-term outcomes after conventional coronary artery bypass grafting (CABG) between patients having left main (LM) disease who should have been assigned class II and those assigned class III recommendation for percutaneous coronary intervention (PCI) according to the 2010 European Society of Cardiology and the European Association for Cardio-Thoracic Surgery guidelines.

METHODS: From January 2000 to December 2009, conventional CABG was routinely employed in 180 consecutive patients with previously untreated and stable LM lesion. A comparison between two groups (CABG for PCI class II and CABG for PCI class III) was performed, looking at the primary endpoint of major adverse cardiac and cerebrovascular events (MACCE), including all-cause death, stroke [cerebral vascular accident (CVA)], myocardial infarction (MI) and repeat revascularization. We also analysed the effects of variables on MACCE at 8 years after the operation.

RESULTS: The overall 8-year MACCE rates were significantly lower in the CABG for PCI class II group than in the CABG for PCI class III group (9.7% class II vs 31.1% class III; \(P = 0.0005\)). This was largely because of an increased rate of repeat revascularization (1.2% class II vs 13.8% class III; \(P = 0.0029\)). The cumulative rate of the combined outcomes of all death/CVA/MI was significantly lower in the CABG for PCI class II group (8.5% class II vs 19.2% class III; \(P = 0.048\)); there was no observed difference between the groups for all-cause death, CVA and MI. The SYNTAX score was demonstrated to be the only significant predictor of combined outcomes (Death/CVA/MI) at 8 years [odds ratio (OR) 1.05, \(P = 0.023\)], repeat revascularization at 8 years (OR 1.11, \(P = 0.0013\)) and MACCE at 8 years (OR 1.07, \(P < 0.0001\)).

CONCLUSIONS: In our routine strategy of conventional CABG for LM disease, patients believed to be PCI candidates for LM disease have significantly better long-term outcomes as characterized by combined outcomes (Death/CVA/MI), repeat revascularization and MACCE. These results provide a suitable benchmark against which long-term outcomes of PCI for LM disease can be compared. The SYNTAX score, which was introduced to determine treatment for complex coronary disease, is indicative of long-term outcomes after CABG for LM disease.

Keywords: Conventional CABG • Left main disease • Major adverse cardiac and cerebrovascular events • SYNTAX score • 2010 ESC/EACTS • Percutaneous coronary intervention recommendation

INTRODUCTION

Coronary artery bypass grafting (CABG) was introduced in 1968 and has been the preferred option for symptomatic patients with coronary artery disease [1]. Advances in CABG, with use of in situ arterial conduits and improved postoperative intensive care, have led to better graft patency and reduced mortality and morbidity [2, 3]. Since the inception of percutaneous coronary intervention (PCI) in 1977, interventional cardiologists, using coronary drug-eluting stents (DES) and improved technology, have been steadily expanding the application of PCI to patients with complex multiple lesions, including left main (LM) disease [4, 5]. Recent revisions to revascularization guidelines have reflected these improvements in PCI outcomes for patients with complex coronary disease [6, 7].

The introduction of DES has been reported to reduce the number of CABG operations and to increase the preoperative risk of CABG candidates by substituting for CABG in patients with mild-to-moderate risk, although the therapeutic effectiveness of DES compared with CABG is still under scientific evaluation [8, 9]. In Japan, which is the second largest market for DES in the world, cardiologists have quickly and enthusiastically adopted DES, resulting

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in a marked expansion of PCI, ~10 times the number of CABG procedures in a recent year [10].

The SYNTAX trial is the first large trial to assess the most appropriate revascularization strategy by randomizing patients to either CABG or PCI using DES for the treatment of LM and/or three-vessel disease [11]. At 3-year follow-up of the SYNTAX trial, it was found that major adverse cardiac and cerebrovascular events (MACCE), repeat revascularization, mortality and the combined safety endpoint of death, of myocardial infarction (MI) and of stroke [cerebral vascular accident (CVA)], were significantly increased with PCI for three-vessel disease patients; in contrast, for patients with LM disease, there were no significant differences in these outcomes except for repeat revascularization after PCI compared with outcomes after CABG [12]. Recently, Mohr et al. [13] reported 5-year results of the SYNTAX trial in which CABG should remain the standard of care for patients with complex multivessel disease although in patients with less complex disease, such as LM lesion with low or intermediate SYNTAX scores or three-vessel disease with low SYNTAX scores, PCI is an acceptable alternative.

Thus, the 2010 European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS) guidelines have revised the PCI recommendation for LM disease with a class IIa indication for ostial or shaft lesions (either isolated or in the presence of one-vessel disease) and with a class IIb indication for isolated distal disease or with coexisting one-vessel disease. However, PCI for LM disease is considered to be contraindicated (a class III indication) in patients with additional two- or three-vessel disease and a calculated SYNTAX score of ≥33 [6].

We have nevertheless routinely employed CABG during the last decade for LM disease even in patients with cardiogenic shock due to ongoing ischaemia or in those who would be recommended PCI class IIa or IIb (class II) according to the ESC and EACTS guidelines [6]. These CABGs were performed in the conventional fashion of on-pump arrest in order to achieve long-term graft patency with the aim of achieving good long-term outcomes [2, 14]. In the present study, we retrospectively analysed long-term outcomes, with routine use of conventional CABG for previously untreated and stable LM lesion, between patients who should have been given class II and those given class III recommendation for PCI. Our ultimate objective is to document long-term outcomes to act as a benchmark for results after PCI for LM disease.

**MATERIALS AND METHODS**

After approval from our institution ethics committee/institutional review board, a retrospective review was carried out on 180 consecutive patients [144 (80.0%) men and 36 (20.0%) women] having a mean age of 67 ± 9 years, who underwent conventional CABG for previously untreated and stable LM lesion from January 2000 to December 2009. The LM disease was defined as at least 50% stenosis with or without stenosis in other vessels. The key exclusion criteria were the need for other concomitant cardiac surgery, previous PCI or CABG or the use of intra-aortic balloon pumping (IABP) for haemodynamic stability. Patients who had acute MI were included in the study group.

All diagnostic angiographies and electrocardiographies were reviewed by the cardiologists, who were blinded to the study group. The SYNTAX scores were calculated retrospectively according to the SYNTAX score algorithm [15]. The present article focused on long-term outcomes after conventional CABG for patients with LM disease who could have been either recommended PCI at a class II indication (PCI class II group) or contraindicated PCI (PCI class III group), based on the 2010 ESC and EACTS guidelines [6]. The 2010 ESC and EACTS guidelines provided PCI recommendation for LM disease as follows: (i) class Ila indication for isolated LM ostial/shaft disease with or without one-vessel disease; (ii) class IIb for isolated LM distal disease with or without one-vessel disease, or for any LM with two-, three-vessel disease with SYNTAX score ≤32 and (iii) class III for any LM with two-, three-vessel disease with SYNTAX score >33.

Patients were treated with the aim of achieving complete revascularization of all vessels at least 1.5 mm in diameter with stenosis >50%. CABG was performed during cardiac arrest with cold crystalsloid or blood cardioplegia and local cooling. The heart was bypassed using one or two internal mammary artery (IMA) as an in situ graft, and vein grafting. Aspirin was prescribed for all patients prior to CABG. Completeness of early revascularization was assessed post-procedure using an ultrasonic Doppler flowmeter, and confirmed by the coronary graft angiography or computed tomography 2 weeks after the operation.

Follow-up information was obtained during patients’ visits. Coronary and graft angiography was performed 1 year after the operation. Patent graft was defined as a graft without occlusion, significant stenosis (>90%) or string sign. String sign was defined as luminal narrowing throughout the entire conduit, including stenosis ≥90%. Grafts with competitive flow or reverse flow were considered patent unless they had occlusion, significant stenosis or string sign.

The primary endpoint was a MACCE during follow-up, including death by any cause, CVA, MI and repeat revascularizations [11, 12]. CVA, specifically cerebrovascular events or stroke, was considered focal neurological deficits of central origin lasting for 72 h, confirming permanent brain damage or body impairment. MI was defined via new Q-waves or peak CKP-MB/total CK >10% or a plasma level of CK-MB >100 U/l. Repeat revascularization was defined as a coronary intervention or repeat CABG after CABG for symptomatic graft occlusion or acute coronary syndrome, with confirmed occlusion within or adjacent to a previously treated graft.

Continuous data including SYNTAX score and EuroSCORE are presented as mean ± standard deviation. Comparison between the two groups undergoing CABG for patients with PCI recommendation class II and those with PCI recommendation class III was performed using the t-test for normally distributed data which was confirmed by the F-test. Categorical data were expressed as percentages. Proportions were analysed by x² or the Fisher’s exact test, as appropriate. The Kaplan–Meier actuarial survival and event-free rate were calculated for the two groups, and differences between the two groups were assessed using the log-rank test. A Cox proportional-hazards model was used to analyse the effects of variables on combined outcomes (Death/CVA/MI), repeat revascularization and MACCE, treating CABG as a time-dependent covariate. Variables included demographics, physical examination findings, electrocardiography and echocardiography measurements; these and the procedural characteristics that were significantly associated with the events were entered into a multivariate analysis. A P-value of <0.05 was considered statistically significant. All statistical analyses were performed using SPSS 17.0.

**RESULTS**

Table 1 sets out preoperative clinical characteristics in patients with LM disease who were deemed to be PCI candidates class II and PCI candidates class III according to the 2010 ESC and EACTS
The mean age of the patients was 65.1 ± 10.1 in the CABG for PCI class II and 67.2 ± 7.8 in the CABG for PCI class III group. Sixty three (76.8%) patients in the CABG for PCI class II and 81 (82.7%) in the CABG for PCI class III group were male, and 37 (45.1%) in the CABG for PCI class II and 44 (44.9%) in the CABG for PCI class III group had medically treated diabetes. Patients undergoing CABG for PCI class II had significantly fewer multiple vessel lesions than those who underwent CABG for PCI class III (CABG for PCI class II; LM + 2 vessel n = 20 (24.4%) and LM + 3 vessel n = 16 (19.5%), CABG for PCI class III; LM + 2 vessel n = 21 (21.4%) and LM + 3 vessel n = 73 (74.5%). The SYNTAX score was 17.9 ± 4.0 in the CABG for PCI class II group and 35.7 ± 5.6 in the CABG for PCI class III group. The SYNTAX score was significantly higher in the CABG for PCI class III group (P < 0.0001). Patients undergoing CABG for PCI class III were likely older, less obese and were likely to have lower ejection fraction than patients who underwent CABG for PCI class II. The EuroSCORE for assessing risk factors for mortality in cardiac surgical adult patients preoperatively [16] did not show a statistically significant difference between the two groups (4.3 ± 2.8 in the CABG for PCI class II group, and 4.7 ± 4.2 in the CABG for PCI class III group, P = 0.44).

Table 2 shows procedural characteristics in patients undergoing CABG for LM disease. In the CABG for PCI class II group, the aortic clamp time and pump time were significantly shorter, and the bypass number was significantly less than in the CABG for PCI class III group (P < 0.0001). More patients in the CABG for PCI class II had complete revascularization than patients in the CABG for PCI class III group without a significant difference (P = 0.23). There was no significant change between the two groups in mortality, morbidity such as periprocedural CVA and MI, ICU stay or hospital stay between the two groups.

Figure 1 shows the rates of the combined outcomes of Death/ CVA/MI and its components through 8 years, analysed in a time-to-event manner. The cumulative rate of the combined safety endpoints was significantly lower in the CABG for PCI class II group than in the class III group (8.5% class II vs 19.2% class III; P = 0.048; Fig. 1A). Among the safety components, there was no significant difference at 8 years between CABG for PCI class II and class III groups in terms of all-cause death (3.7% class II vs 6.8% class III; P = 0.35; Fig. 1B), CVA (1.9% class II vs 8.2% class III; P = 0.17; Fig. 1C) or MI (3.1% class II vs 5.0% class III; P = 0.25; Fig. 1D).

A total of 154 (85.6%) patients received angiographic evaluation at 1 year after CABG. The angiography-confirmed graft occlusion rate in the LAD grafts using IMA was 2.6% (1 patient in the CABG for PCI class II group and 3 patients in the CABG for PCI class III group), and 14.4% in other grafts. Two patients with occluded IMA-LAD graft received repeat revascularization with PCI subsequently without mortality or morbidity. Figure 2 shows the repeat revascularization rate after CABG in the two groups. Repeat revascularization at 8 years after CABG was significantly reduced in patients deemed to be PCI candidates class II compared with those deemed to be PCI candidates class III (1.2% class II vs 13.8% class III; P = 0.0029; Fig. 2). During the 8-year follow-up, all the patients who required repeat revascularization underwent PCI and the majority received PCI within 2 years of CABG.

During the follow-up, which extends to 8 years (mean: 62 ± 32 months), MACCE occurred in 6 patients (7.3%) in the CABG for PCI class II group and in 28 patients (28.6%) in the CABG for PCI class III group. Table 3 sets out primary clinical endpoints in each group. The patients who underwent CABG for PCI class II recommendation had a significantly lower MACCE rate at 8 years (odds ratio (OR) 0.24, P = 0.0014), driven by better survival, lower CVA
and MI rate, and significantly less repeat revascularization (OR 0.09, \( P = 0.019 \)) compared with patients undergoing CABG for PCI class III recommendation. The 8-year MACCE rates were significantly lower in the CABG for PCI class II group than in the PCI class III group (9.7% class II vs 31.1% class III; \( P = 0.0005 \). Fig. 3).

Table 4 shows multivariate predictors of 8-year combined outcomes, repeat revascularization and MACCE in a Cox proportional-hazards model. For the combined outcomes of Death/CVA/MI at 8 years in the overall population, only the SYNTAX score significantly predicted increased risk (OR 1.05, \( P = 0.023 \)). The SYNTAX score (OR 1.11, \( P = 0.0013 \)) and cardiac arrest time (OR 1.03, \( P = 0.042 \)) were identified as the significant multivariate predictors of increased repeat revascularization at 8 years. In the overall population, only the SYNTAX score (OR 1.07, \( P < 0.0001 \)) remained a significant multivariate predictor of increased MACCE at 8 years.

**DISCUSSION**

CABG reduces mortality relative to optimal medical therapy in high-risk patients with both complex coronary disease and left ventricular dysfunction; this reduction is particularly clear in patients with higher atheroma burden such as older age, diabetes mellitus and multivessel disease, according to randomized control trials \[17\]. Recently, PCI has been increasingly applied to patients with complex coronary disease, including LM. PCI for unprotected LM with limited additional diseases have been revised to a class II recommendation in recent US and European guidelines \[6, 7\]. In the prespecified subgroup of the SYNTAX trial, patients with LM disease treated with DES demonstrated safety and efficacy at 1 year, comparable with CABG \[18\]. During the further follow-up beyond 5 years, PCI was reported to be a reasonable alternative treatment to CABG for patients of LM disease with low or intermediate SYNTAX score \[13\]. However, longer follow-up is still necessary, because the trial also found a significantly higher rate of repeat revascularization in the PCI cohort than in the CABG cohort \[12, 18\].
In our multivariate analysis, however, the only significant predictor of combined outcomes, repeat revascularization and MACCE was associated with the SYNTAX score (OR 1.05, P = 0.0014). These results suggest that the SYNTAX score, which was introduced to measure the complexity of coronary artery disease, is a useful tool for predicting long-term outcomes after CABG or PCI for LM disease.

In the present study, we retrospectively reviewed the medical records of 180 consecutive patients with previously untreated and stable LM lesion who underwent CABG or PCI for LM disease during the period from 2005 to 2015. The study was approved by the institutional review board, and written informed consent was obtained from all patients. The primary endpoints were to compare the long-term outcomes of CABG and PCI for LM disease.

We have routinely employed conventional CABG in the last decade for LM disease, even in patients who required IABP due to cardiogenic shock. In the present study, our retrospective review of 180 consecutive patients with previously untreated and stable LM lesion showed excellent long-term results with 0.6% perioperative mortality (n = 1; due to rupture of abdominal aneurysm), no perioperative CVA, 91.4% overall survival at 9 years and 21.6% overall MACCE rate at 8 years. We also set out the findings of our single-institution study examining long-term outcomes after conventional CABG in patients with LM disease who might have been PCI candidates in the class II recommendation group (CABG for PCI class II) and those in patients contraindicated PCI in the class II recommendation group (CABG for PCI class III) according to the 2010 ESC and the EACTS guidelines.

During the long-term follow-up beyond 8 years, the rates of the combined outcomes of Death/CVA/MI, repeat revascularization and MACCE, were significantly lower in the CABG for PCI class II group than in the CABG for PCI class III group. Thus, patients believed to be PCI candidates for LM disease had significantly better long-term outcomes in terms of combined safety endpoint, repeat revascularization and MACCE, after conventional CABG, relative to those believed not to be candidates for PCI, according to the 2010 ESC/EACTS guidelines. In the literature review, there was no article that disclosed long-term outcomes after CABG employed routinely for the patients with LM disease, particularly for those who should have been assigned class II recommendation for PCI. Our data also provide a benchmark against which long-term outcomes of PCI for LM disease can be compared.

In the 5-year results of the SYNTAX trial, the MACCE rate after CABG in LM subgroup was 31.5% for low risk (baseline SYNTAX score 0–22), 32.3% for intermediate risk (baseline SYNTAX score 23–32) and 29.7% for high risk (baseline SYNTAX score ≥33), respectively [13]. The MACCE rate after CABG for LM disease was reported to be independent of the SYNTAX score. In contrast, our 8-year MACCE rate, which was demonstrated to be associated with the SYNTAX score, was significantly lower in the CABG for PCI class II group (9.7%) compared with the CABG for PCI class III group (31.1%). We routinely employed conventional CABG for the better long-term graft patency and confirmed early revascularization of the culprit lesion mainly by the coronary graft angiography during hospitalization. We speculate that these kinds of management associated with less atherosclerotic anastomoses sites in the CABG for PCI class II patients having low or intermediate SYNTAX score might have contributed to the lower incidence of repeat revascularization which mainly affected the MACCE rate.

We have routinely employed conventional CABG in the last decade for LM disease, even in patients who required IABP due to cardiogenic shock. In the present study, our retrospective review of 180 consecutive patients with previously untreated and stable LM lesion showed excellent long-term results with 0.6% perioperative mortality (n = 1; due to rupture of abdominal aneurysm), no perioperative CVA, 91.4% overall survival at 9 years and 21.6% overall MACCE rate at 8 years. We also set out the findings of our single-institution study examining long-term outcomes after conventional CABG in patients with LM disease who might have been PCI candidates in the class II recommendation group (CABG for PCI class II) and those in patients contraindicated PCI in the class II recommendation group (CABG for PCI class III) according to the 2010 ESC and the EACTS guidelines.

Table 3: Primary clinical endpoints in the CABG patients deemed to be PCI-recommended in the class II group and in the class III group

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>CABG for PCI class II (n = 82)</th>
<th>CABG for PCI class III (n = 98)</th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death (%)</td>
<td>3 (3.7)</td>
<td>7 (7.1)</td>
<td>0.53 (0.14–2.05)</td>
<td>0.36</td>
</tr>
<tr>
<td>CVA (%)</td>
<td>1 (1.2)</td>
<td>7 (6.5)</td>
<td>0.25 (0.03–2.12)</td>
<td>0.20</td>
</tr>
<tr>
<td>MI (%)</td>
<td>0</td>
<td>3 (2.8)</td>
<td>0.30 (0.03–2.66)</td>
<td>0.28</td>
</tr>
<tr>
<td>Repeat revascularization (%)</td>
<td>2 (2.4)</td>
<td>11 (12.0)</td>
<td>0.09 (0.01–0.67)</td>
<td>0.019</td>
</tr>
<tr>
<td>MACCE (%)</td>
<td>6 (7.3)</td>
<td>28 (28.6)</td>
<td>0.24 (0.10–0.58)</td>
<td>0.0014</td>
</tr>
</tbody>
</table>

CABG: coronary artery bypass grafting; CVA: cerebral vascular accident; MACCE: major adverse cardiac and cerebrovascular events; MI: myocardial infarction; OR: odds ratio; PCI: percutaneous coronary intervention.
Table 4: Multivariate Cox regression model for combined outcomes (death/CVA/MI), repeat revascularization and MACCE

<table>
<thead>
<tr>
<th></th>
<th>Combined outcomes (Death/CVA/MI)</th>
<th>Repeat revascularization</th>
<th>MACCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>P-value</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>Male gender</td>
<td>0.93 (0.31–2.74)</td>
<td>0.89</td>
<td>0.35 (0.11–1.10)</td>
</tr>
<tr>
<td>Age</td>
<td>1.07 (1.00–1.14)</td>
<td>0.058</td>
<td>0.93 (0.87–1.00)</td>
</tr>
<tr>
<td>EuroSCORE</td>
<td>1.01 (0.88–1.17)</td>
<td>0.89</td>
<td>1.03 (0.93–1.15)</td>
</tr>
<tr>
<td>SYNTAX score</td>
<td>1.05 (1.01–1.09)</td>
<td>0.023</td>
<td>1.11 (1.04–1.18)</td>
</tr>
<tr>
<td>Cardiac arrest time</td>
<td>–</td>
<td>–</td>
<td>1.03 (1.00–1.05)</td>
</tr>
<tr>
<td></td>
<td></td>
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</tbody>
</table>

CVA: cerebral vascular accident; MI: myocardial infarction; MACCE: major adverse cardiac and cerebrovascular events; OR: odds ratio; PCI: percutaneous coronary intervention.

complexity and severity of atherosclerotic coronary artery disease, is indicative of long-term outcomes after CABG for LM disease.

In the present study, the EuroSCORE, which could assess risk factors for cardiac surgical mortality, was not identified as an independent predictor of long-term outcomes after CABG for LM disease. We speculate that the main reason for the significantly lower MACCE rate after CABG in patients recommended PCI class II was the significantly less repeat revascularization rate and not by the survival including operative mortality which could be estimated by the EuroSCORE. In this respect, the SYNTAX score coupled with additive EuroSCORE or several clinical variables including measures of frailty could precisely evaluate long-term outcomes and clinical risk in the patients with complex coronary disease.

The increased risk of repeat revascularization was revealed to be associated with longer cardiac arrest time (OR 1.03, P = 0.042) besides the SYNTAX score (OR 1.11, P = 0.0013). We speculate that a longer cardiac arrest time, associated with the poor prognosis in repeat revascularization, is related to the complexity of coronary artery disease in the target lesion, namely severely atherosclerotic or small vessel, which is not accounted for in the SYNTAX score algorithm.

We mainly performed CABG with the use of cardiopulmonary bypass and cardioplegic arrest (conventional CABG). There has been interest since the mid-1990s in performing CABG without cardiopulmonary bypass (off-pump CABG) so as to reduce complications related to the heart–lung machine, including mortality, cerebral dysfunction and systemic inflammation responses. Furthermore, off-pump CABG in patients with LM disease reportedly reduced early mortality and morbidity and revealed similar long-term survival to conventional CABG [21]. A systematic review and meta-analysis of propensity score analyses indicated that off-pump CABG was superior to on-pump CABG in all short-term outcomes assessed, including mortality, stroke, renal failure, red blood cell transfusion, wound infection, prolonged ventilation, inotropic support and IABP support [22]. In the single-blind randomized ROOBY trial, however, patients in the off-pump group had worse combined death or complications (reoperation, new mechanical support, cardiac arrest, coma, stroke or renal failure) and poor graft patency relative to patients in the on-pump group, at 1-year follow-up [23]. Moreover, a cumulative analysis and meta-analysis documented a reduction in postoperative patency of bypass grafts after off-pump CABG [24]. In the randomized single-surgeon trial, however, Puskas et al. [25] reported that off-pump CABG achieved graft patency, cardiac outcomes and health-related quality of life similar to those of conventional CABG during 1-year follow-up. In our univariate and multivariate analysis, the graft occlusion rate at 1 year after the operation was not proved to be a predictor of MACCE nor of MACCE components (data not shown). However, we believe that long-term graft patency after conventional CABG using in situ IMA gives excellent long-term outcomes, with 91.4% overall survival after 9 years and 21.6% overall MACCE rate after 8 years.

The main limitation of this study is its retrospective nature and the lack of the joint assessment by the heart team to classify whether patients were equally suitable for revascularization with CABG and PCI in this retrospective setting. Even though this was a relatively large cohort of patients routinely undergoing CABG for LM disease, patients suitable only for PCI might be entered in the study group. We do believe, however, that our excellent long-term outcomes after conventional CABG for the patients with LM disease support physicians to determine the optimal revascularization method to whom should be assigned class II recommendation for PCI. In addition, our long-term graft patency failed to affect long-term outcomes. Thus, it is important to note that, although we described excellent results employing conventional CABG for the long-term graft patency, this study was not designed to assert that conventional CABG is superior to off-pump CABG.

CONCLUSIONS

In our routine strategy of conventional CABG for LM disease, patients believed to be PCI candidates for LM disease have significantly good long-term outcomes as characterized by combined safety endpoint, repeat revascularization and MACCE. The SYNTAX score, which was introduced to determine treatment for complex coronary disease, is indicative of long-term outcomes after CABG for LM disease. These results provide a benchmark against which long-term outcomes of PCI for LM disease can be compared.

Conflict of interest: none declared.

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