Drug-coated balloons: A better revascularization strategy in patients with multivessel coronary artery disease undergoing one-stop hybrid coronary revascularization surgery

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ABSTRACT

Background: The optimal revascularization strategy for non-left anterior descending coronary artery (LAD) lesions during one-stop hybrid coronary revascularization (HCR) surgery lacks current evidence.

Aims: This study aimed to compare the outcomes of the drug-coated balloon (DCB) and drug-eluting stent (DES) strategies in patients with non-small non-LAD lesions undergoing one-stop HCR.

Methods: A total of 141 consecutive patients with multivessel coronary artery disease (MVCAD) undergoing one-stop HCR between June 1, 2018 and March 1, 2022 were retrospectively included in this study. In-hospital outcomes and mid-term major adverse cardiovascular and cerebrovascular events (MACCE) were observed. Kaplan-Meier curve analysis was used to evaluate the MACCE-free survival rate. The Cox proportional hazard model was used to identify risk factors of mid-term MACCE.

Results: Thirty-eight and 103 patients received only DCB or DES therapy, respectively, in this study. There were no significant differences in demographic characteristics and laboratory parameters between the two groups. The in-hospital MACCE rate in the DES group was numerically higher than that in the DCB group (9.7% vs. 5.3%, respectively), but the difference was not statistically significant ($P = 0.4$). The incidence of MACCE after patients' discharge was significantly higher in the DES group (22% vs. 5.3%, respectively, $P = 0.02$) during a median follow-up of 20 months. In multivariable Cox proportional hazard analysis, DCB therapy was independently associated with reduced risk of mid-term MACCE (hazard ratio, 0.21; 95% confidence interval, 0.06–0.91; $P = 0.04$).

Conclusion: For patients with MVCAD undergoing one-stop HCR, DCB therapy may be the optimal revascularization strategy for non-small non-LAD coronary artery lesions with a significantly lower rate of mid-term MACCE.

Key words: drug-coated balloon, hybrid coronary revascularization, major adverse cardiovascular and cerebrovascular events, percutaneous coronary intervention, prognosis

INTRODUCTION

For patients with multivessel coronary artery disease (MVCAD), coronary artery bypass grafting (CABG) remains the gold standard of treatment, and the longevity of the left internal mammary artery (LIMA) to left anterior descending (LAD) graft provides most of the survival benefit of that surgery [1, 2]. One-stop hybrid coronary revascularization (HCR) combines the benefit of long-term survival after LIMA-LAD grafting with the less invasive percutaneous coronary intervention (PCI) procedure for non-LAD lesions and achieves complete revascularization (CR) [3]. Previous studies have demonstrated safety and feasibility of one-stop HCR; this revas-

WHAT'S NEW?

One-stop hybrid coronary revascularization (HCR) combines grafting the left internal mammary artery (LIMA) to the left anterior descending (LAD) with the less invasive percutaneous coronary intervention procedure for non-LAD lesions and achieves complete revascularization, giving patients the benefit of long-term survival. In patients with multivessel coronary artery disease undergoing one-stop HCR, a drug-coated balloon might be a better revascularization strategy for non-small non-LAD lesions compared to a drug-eluting stent, with a significantly reduced rate of mid-term major adverse cardiovascular and cerebrovascular events.

cularization strategy may provide favorable outcomes in selected patients with MVCAD compared with CABG and PCI [3–5].

Drug-coated balloon (DCB) is a novel revascularization strategy for atherosclerotic lesions. It can deliver quickly antiproliferative drugs into the vessel wall during balloon inflation with no permanent implants [6]. The rapid advancement of the DCB technique has changed the strategy of PCI treatment to some extent, the safety and efficacy of DCB have been demonstrated for *de novo* coronary lesions (e.g., small-vessel disease, non-small-vessel disease, and bifurcation lesions) and in-stent restenosis (ISR). However, data on the application of DCB during one-stop HCR are scarce, and the optimal revascularization strategy for non-small coronary artery lesions in non-LAD vessels in MVCAD patients undergoing one-stop HCR remains under-researched.

Hence, our study aimed to investigate the short and mid-term outcomes of different revascularization strategies (DCB vs. drug-eluting stent, [DES]) for non-small non-LAD lesions during one-stop HCR in patients with MVCAD.

METHODS

Study population

This is a retrospective study including 141 consecutive MVCAD patients undergoing one-stop HCR from June 1, 2018 to March 1, 2022 in the Beijing Chaoyang Hospital (Figure 1). The choice of revascularization strategies was discussed by the Heart Team, including interventional cardiologists, cardiac surgeons, and anesthesiologists to make the most appropriate decision regarding CABG, PCI, or HCR.

The inclusion criteria for one-stop HCR were as follows (1) MVCAD (lumen diameter stenosis larger than 50% in at least two major coronary arteries) confirmed by coronary angiogram (CAG), involving unprotected left main (LM) or LAD lesions not suitable for PCI, with non-LAD lesions amenable to PCI; (2) patients were not suitable for traditional CABG due to poor condition of the right coronary artery (RCA) or the left circumflex artery (LCx) for bypass, lack of available conduits, contraindications for sternotomy, or request for less invasive procedures. The exclusion criteria were (1) contraindications to minimally invasive LIMA-LAD grafting, such as a history of sternotomy, stenosis of the left subclavian artery or the LIMA, distal LAD anastomosis impracticable, etc.; (2) need for a concomitant cardiac surgery, such as valve repair or replacement; (3) small non-LAD coronary artery lesions (diameter ≤2.5 mm); (4) significant hemodynamic instability.

This study was approved by the Ethics Committee of the Beijing Chaoyang Hospital (2021-D-5). Written informed consent was obtained from all participants.

One-stop HCR surgery and antithrombotic therapy

Aspirin was continued perioperatively (100 mg/day) and clopidogrel was discontinued at least 7 days before surgery. Minimally invasive direct coronary artery bypass and PCI were performed in a hybrid operation room simultaneously. Briefly, a LIMA conduit was harvested through a small (5 to 7 cm) anterior thoracotomy in the fourth or fifth intercostal space, and the distal anastomosis of in situ LIMA-LAD grafting was performed through the same incision. After thorax closure, angiography was performed immediately to assess the patency of the LIMA-LAD graft through the femoral artery (FA). After confirmation of LIMA-LAD graft patency, a loading dose of clopidogrel (300 mg) was administered through the nasogastric tube, and PCI was then performed on non-LAD lesions through the FA. Unfractionated heparin was administered before PCI and the activated clotting time (ACT) remained between 250 and 350 seconds during the PCI procedure. Patients in the DCB therapy group received the paclitaxel-coated balloon SeQuent Please (B Braun Melsungen AG, Melsungen, Germany) and patients in the DES therapy group received one of the two second-generation DESs: a paclitaxel-eluting Taxus Element stent (Boston Scientific, Natick, MA, US) or an everolimus-eluting Xience stent (Abbott Vascular, Santa Clara, CA, US). The residual stenosis of the target lesions was <20% after DCB or DES treatments. The dosage of aspirin was 100 mg/day from the first day after surgery for a lifetime while the dosage of clopidogrel was 75 mg/day for one year.

Data collection

The demographic features and clinical variables such as age, sex, body mass index (BMI), family and medical history, smoking status, and medications were retrospectively collected from electronic medical records. Venous blood samples were collected and analyzed in the first 6 hours after patients' admission. The SYNTAX score was based on CAG assessment by two professional interventional cardiologists (www.syntaxscore.com). The EuroSCORE II was calculated based on the anatomy of coronary lesions

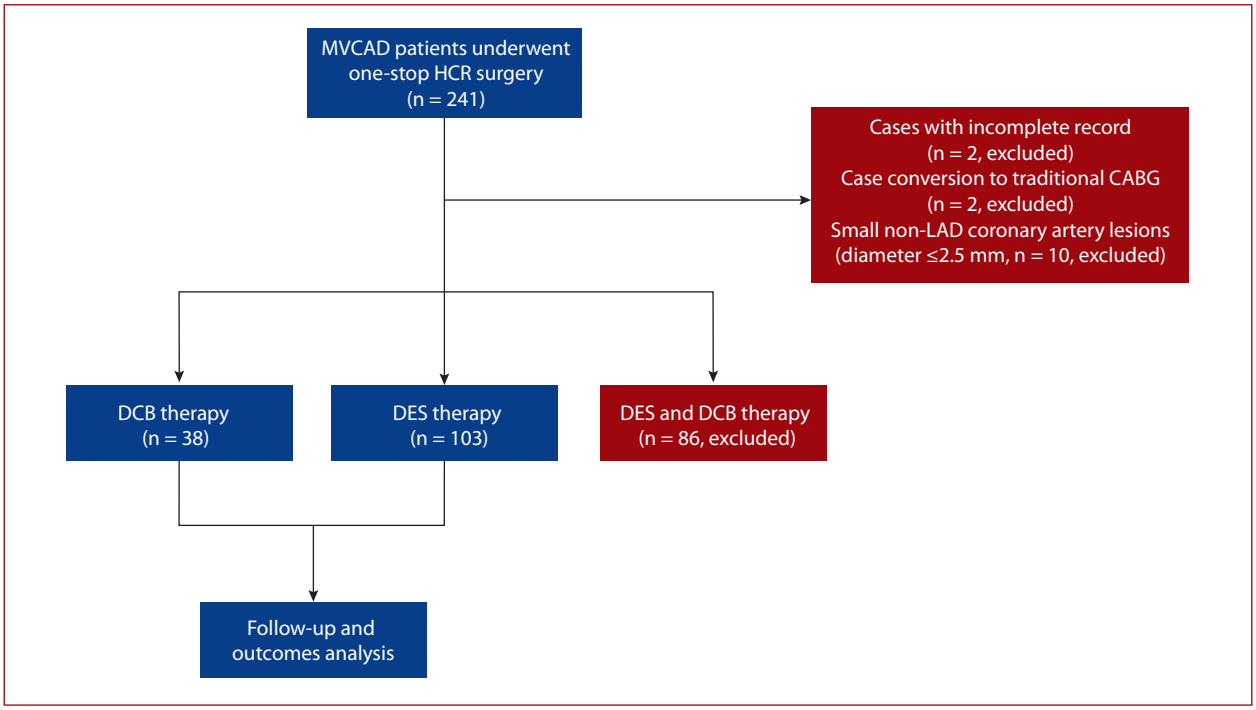

Figure 1. Flowchart of the study

Abbreviations: CABG, coronary artery bypass grafting; DCB, drug-coated balloon; DES, drug-eluting stent; HCR, hybrid coronary revascularization; MVCAD, multivessel coronary artery disease

and baseline risk factors for all patients (www.euroscore.pil-media.com).

Follow-up and outcome measurements

Major adverse cardiovascular and cerebrovascular events (MACCE), including all-cause mortality, stroke, myocardial infarction (MI), and repeated revascularization were the primary endpoint of our study. The composite endpoint was assessed by time to the first event. After discharge, all patients were required to return for outpatient follow-up at one and six months, and then once every year. For patients who did not return for the outpatient visits, phone reviews were conducted by the research staff using standard forms. All phone reviews were completed 1 week before the drafting of the manuscript. The second endpoint was in-hospital outcomes, including all-cause mortality, postoperative MI, stroke, repeated revascularization, new-onset atrial fibrillation (NOAF), incision infection, chest tube drainage, mechanical ventilation time (MVT), length of stay in the intensive care unit (ICU), and hospital stay. The follow-up time was from HCR surgery to event time or to the phone review time.

Statistical analysis

SPSS (Version 23, IBM, US) and STATA software (Version 16.0; Stata Corporation, US) were used for all statistical analyses. The Kolmogorov-Smirnov test was used to test the normal distribution of continuous variables. Normally and abnormally distributed data were expressed as means (standard deviation [SD]) and medians (interquartile ranges [IQR]). Student's t-test and Mann-Whitney U test were used to compare the continuous variables between the two groups. Categorical variables were expressed as a proportion and analyzed with Pearson χ^2 or Fisher's precision probability tests. Logistic regression analyses were used to identify the risk factors for in-hospital outcomes. Kaplan-Meier survival curves with the log-rank test were applied to compare cumulative MACCE-free rates between the two groups. The Cox proportional hazard model analyses (forward conditional method) were conducted to identify independent predictors of mid-term MACCE. A *P*-value <0.05 (two-tailed) was considered statistically significant.

RESULTS

Baseline characteristics

A total of 141 consecutive MVCAD patients (75.2% male) undergoing one-stop HCR were finally enrolled in this study. They were assigned into two groups according to the different revascularization strategies on non-LAD lesions during surgery. Thirty-eight (27%) and 103 (73.1%) patients received DCB and DES therapy, respectively, during one-stop HCR. The mean age of the study population was 64.8 ± 9 (mean and SD) years old. Baseline characteristics of the participants are shown in Table 1, with no significant difference observed between the two groups. All patients received CR treatment during surgery. Fifty-two and 167 non-LAD target lesions were revascularized in the DCB and DES groups, respectively. Compared with DES, the mean length of DCB was longer (28.5 [4.5] mm vs. 24.2 [6.8] mm, respectively; *P* <0.001), but there was no statistical difference between the mean diam-

Table 1. Baseline characteristics of the study population

Variables	DCB therapy (n = 38)	DES therapy (n = 103)	*P*-value
Age, years	64.6 ± 8.5	65.6 ± 9.2	0.56
Male sex, n (%)	33 (86.8)	73 (70.9)	0.08
HT, n (%)	28 (73.7)	75 (72.8)	0.44
DM, n (%)	16 (42.1)	39 (37.9)	0.57
History of MI, n (%)	10 (26.3)	18 (17.5)	0.23
CHF, n (%)	3 (7.9)	4 (3.9)	0.42
CKD, n (%)	0 (0)	1 (1)	0.62
COPD, n (%)	2 (5.3)	1 (1)	0.27
History of PCI, n (%)	12 (31.6)	20 (19.4)	0.17
History of stroke, n (%)	9 (23.7)	23 (22.3)	0.86
Current smoker, n (%)	25 (65.8)	52 (50.5)	0.12
BMI, kg/m^2	26.2 ± 4.9	25.4 ± 3	0.44
Clinical diagnosis			
UAP, n (%)	33 (86.8)	83 (80.6)	0.39
STEMI, n (%)	2 (5.3)	10 (9.7)	0.4
NSTEMI, n (%)	3 (7.9)	10 (9.7)	0.74
Medications			
Statin, n (%)	23 (92)	99 (96.1)	0.93
β-RB, n (%)	18 (72)	67 (65.1)	0.6
ACEI/ARB, n (%)	14 (56)	40 (38.8)	0.33
Laboratory investigations			
HbA1c, %	6.1 (5.7–6.8)	6.2 (5.8–7.4)	0.52
BNP, pg/ml	86.2 (48.0–217.6)	94.5 (37.2–313.2)	0.5
WBC, ×10^9/l	7.2 ± 1.8	7.5 ± 1.6	0.72
CK–MB, ng/ml	1.2 (0.7–2)	1.3 (0.7–2.2)	0.2
cTnI, ng/ml	0.02 (0–1)	0.01 (0–1)	0.17
TC, mmol/l	3.6 ± 1	3.3 ± 0.8	0.5
LDL-C, mmol/l	2.2 ± 1	1.9 ± 0.9	0.49
SCR, μmol/l	70.5 ± 10.1	74.4 ± 11.6	0.24
LVEF, %	65 (53.5–70.5)	64 (60–69)	0.75
Coronary lesions			
LM, n (%)	16 (42.11)	47 (45.6)	0.53
LAD, n (%)	38 (100)	103 (100)	N/A
LCx, n (%)	23 (60.5)	58 (56.3)	0.65
RCA, n (%)	17 (44.7)	51 (49.5)	0.61
Number of DCB/DES, n (%)	1 (1–2)	2 (1–2)	N/A
1	20 (52.6)	49 (47.6)	N/A
2	13 (34.2)	39 (37.9)	N/A
3	5 (13.2)	9 (8.7)	N/A
4	0	4 (3.9)	N/A
5	0	2 (1.9)	N/A
Diameter of DCB/DES, mm	2.9 ± 0.4	3.2 ± 0.4	0.47
Length of DCB/DES, mm	28.5 ± 4.5	24.2 ± 6.8	<0.001
Rotational atherectomy, n (%)	1 (2.6)	2 (1.9)	0.8
IVUS, n (%)	1 (2.6)	3 (2.9)	0.93
Perioperative IABP, n (%)	1 (2.6)	3 (2.9)	0.93
SYNTAX score	28.6 ± 8.3	30.5 ± 9	0.33
EuroSCORE II	1.9 (1–4)	1.5 (1.1–2.4)	0.29
Postoperative outcomes			
In-hospital MACCE, n (%)	2 (5.3)	10 (9.7)	0.4
In-hospital mortality, n (%)	0 (0)	3 (2.9)	0.39
MI, n (%)	2 (5.3)	4 (3.9)	0.66
Stroke, n (%)	0 (0)	4 (3.9)	0.26
Repeated revascularization, n (%)	0 (0)	0 (0)	N/A
Reoperation for bleeding, n (%)	0 (0)	6 (5.8)	0.22
Incision infection, n (%)	3 (7.9)	2 (2)	0.12
NOAF, n (%)	3 (7.9)	5 (4.9)	0.54
MGF, ml/min	21.9 ± 11.4	24.7 ± 14.6	0.36
PI	2.1 (1.9–2.6)	2.2 (1.75–2.6)	0.95
Drainage of first 24 hours, ml	420 (330–640)	490 (320–700)	0.74
MV time, hours	16 (14–17)	16 (15–17)	0.19
ICU stay, hours	78 (66–146)	85 (62–134)	0.28
LOS in hospital, days	20 (16–26)	23 (16–30)	0.39

Data are number (%), mean (SD), or median (IQR)

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, agiotensin receptor blocker; BMI, body mass Index; BNP, B-type natriuretic peptide; CAD, coronary artery disease; CHF, chronic heart failure; CKD, chronic kidney disease; CK–MB, creatine kinase MB; COPD, chronic obstructive pulmonary disease; cTnI, cardiac troponin I; DM, diabetes mellitus; HbA1c, glycated hemoglobin, type A1c; HT, hypertension; IABP, intra-aortic balloon pump; ICU, intensive care unit; IVUS, intravascular ultrasound; LAD, left anterior descending artery; LCx, left circumflex artery; LDL-C, low-density lipoprotein cholesterol; LM, left main artery; LOS, length of stay; LVEF, Left ventricular ejection fraction; MACCE, major adverse cardiovascular and cerebrovascular events; MGF, mean graft flow; MI, myocardial infarction; MV, mechanic ventilation; ND, no difference; NOAF, new onset atrial fibrillation; NSTEMI, non-ST-segment elevation myocardial infarction; PCI, percutaneous coronary intervention; PI, pulsatility index; RCA, right coronary artery; SCR, serum creatinine; STEMI, ST-segment elevation myocardial infarction; TC, total cholesterol; UAP, unstable angina pectoris; WBC, white blood cell; β–RB, β-receptor blocker; other — see Figure 1

Table 2. MACCE characteristics between the two groups

Variables	Total (n = 138)	DCB therapy (n = 38)	DES therapy (n = 100)	*P*-value
MACCE, n (%)	24 (17.4)	2 (5.3)	22 (22)	0.02
All-cause mortality, n (%)	7 (5.1)	0 (0)	7 (7)	0.09
Stroke, n (%)	5 (3.6)	0 (0)	5 (5)	0.16
Re-hospitalization for MI, n (%)	6 (4.4)	1 (2.6)	5 (5)	0.54
Repeated revascularization, n (%)	6 (4.4)	1 (2.6)	5 (5)	0.54

Abbreviations: see Table 1

Table 3. Univariate and multivariable Cox proportional hazards analysis

Variables	Univariate analysis		Multivariable analysis	
	HR (95% CI)	*P*-value	HR (95% CI)	*P*-value
DCB therapy	0.2 (0.05–0.89)	0.03	0.21 (0.06–0.91)	0.04
Male	0.79 (0.33–1.9)	0.6		
Age	1.05 (0.97–1.12)	0.51		
DM	1.22 (0.54–2.74)	0.64		
History of MI	1.72 (0.74–4.01)	0.21		
Current smoker	1.12 (0.5–2.52)	0.79		
HT	1.02 (0.97–1.06)	0.5		
BMI	0.99 (0.89–1.1)	0.86		
LVEF	0.98 (0.94–1.05)	0.67		
PI	1.08 (0.77–1.54)	0.65		
MGF	0.98 (0.95–1.02)	0.38		
Drainage of first 24 hours	1 (0.99–1.01)	0.06		
Number of DES	1.47 (1.03–2.11)	0.04	1.35 (1.02–2.08)	0.04
Number of DCB	0.57 (0.4–1.12)	0.09		
SYNTAX score	1.02 (0.98–1.06)	0.44		
EuroSCORE II	2.24 (1.11–3.73)	0.03	2.16 (1.09–3.51)	0.04

Abbreviations: HR, hazard ratio; other — see Table 1

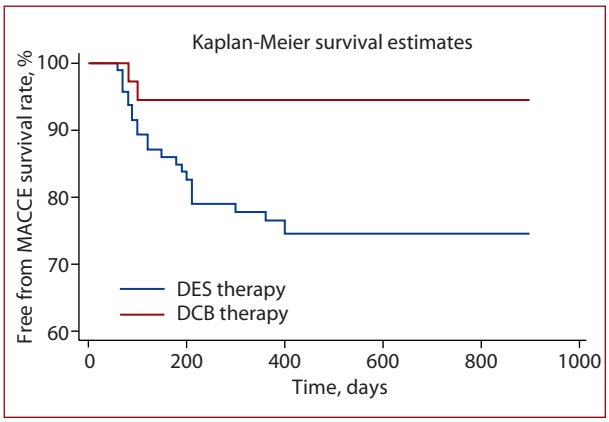

Figure 2. Kaplan-Meier curves for cumulative MACCE-free survival rate (log-rank *P* = 0.02). Abbreviations: see Figure 1 and Table 1

eter of DCB and DES (2.9 [0.4] mm vs. 3.2 [0.4] mm; *P* = 0.47). A total of 13 postoperative MACCE (9.2%) occurred during hospitalization: three cases of all-cause mortality (2.1%), six cases of MI (4.3%), and four cases of stroke (2.8%). After logistic regression analysis, DCB therapy was associated with a trend of lower in-hospital MACCE incidence (odds ratio [OR], 0.517; 95% confidence interval [CI], 0.108–2.474; *P* = 0.4).

MACCE-free survival rates between the two groups

During a median (IQR) follow-up time of 20 (11–30) months after patients' discharge, a total of 24 MACCE (17.4 %) occurred (Table 2). The incidence of MACCE was significantly lower in the DCB therapy group (5.3% vs. 22%; *P* = 0.02), but significant differences were not observed between the two groups (all *P* with no difference, Table 2). The Kaplan-Meier survival analysis showed a significantly increased MACCE-free survival rate in the DCB therapy group (94.7% vs. 78%, log-rank *P* = 0.02, Figure 2).

Cox proportional hazards analysis for risk factors of MACCE

The univariate Cox proportional hazards analysis showed that DCB therapy was correlated with lower risk of mid-term MACCE (hazard ratio [HR], 0.2; 95% CI, 0.05–0.89; *P* = 0.03, Table 3). After multivariable adjustment, the number of DES (HR, 1.35; 95% CI, 1.02–2.08; *P* = 0.04) and EuroSCORE II (HR, 2.16; 95% CI, 1.09–3.51; *P* = 0.04) were independent predictors of mid-term MACCE, and DCB therapy was independently associated with mid-term MACCE-free survival (HR, 0.21; 95% CI, 0.06–0.91; *P* = 0.04, Table 3).

DISCUSSION

In this study, we demonstrated that DCB therapy was associated with a trend to a lower in-hospital MACCE rate and was independently related to a decrease in the mid-term MACCE incidence in MVCAD patients undergoing one-stop HCR. To the best of our knowledge, this is the first study that evaluated the optimal revascularization strategy for non-small non-LAD lesions during one-stop HCR surgery in the MVCAD population.

MVCAD accounts for 40%–60% of patients undergoing CAG and has significantly worse prognosis compared to single-vessel disease [7]. Traditional CABG is recommended by the current guidelines as the gold standard of treatment for MVCAD patients [1, 8]. However, CABG is relatively high-risk, and despite long-term patency of LIMA-LAD graft, the saphenous venous graft (SVG) to a non-LAD vessel is prone to progressive stenosis, with the patency rate from about 80% at one year to an average of 70% at five years, and the patency rate at ten years is less than 60% [2, 9]. With the rapid development of PCI techniques, PCI has become an alternative to CABG, and the long-term outcomes of PCI with new-generation DES are not inferior to those of CABG in patients with low to intermediate SYNTAX scores [10]. However, long-term target lesion restenosis is still a big issue with DES, especially in patients with MVCAD or higher SYNTAX scores [11, 12].

Minimally invasive strategies for surgical myocardial revascularization have drawn a lot of attention in recent years, particularly the one-stop HCR technique [13]. One-stop HCR combines the advantages of long-term LIMA-LAD graft patency and reduced invasiveness of the PCI procedure for non-LAD lesions and achieves complete coronary revascularization at once [10]. It has been shown that the complete coronary revascularization strategy improves prognosis of MVCAD patients, whether it is accomplished by PCI or CABG [14, 15]. One-stop HCR can not only achieve the goal of CR but also reduce the incidence of ischemic events during the waiting period caused by incomplete revascularization of staged PCI or HCR [16, 17]. Additionally, in one-stop HCR, operators can evaluate the LIMA-LAD anastomosis immediately after grafting and revise it if there are any major problems [18]. Moreover, it is suggested that complex PCI should be performed with the protection of LAD territory, which can be supplied by the LIMA-LAD graft, and surgical bailout can be used in cases of possible complications in the hybrid suite if necessary [13]. Finally, the one-stop procedure reduces the length of hospital stays, costs, and readmissions of patients, which is convenient for patients and significantly improves their satisfaction [13].

The safety and feasibility of one-stop HCR have been shown by many studies. A study by Shen et al. [3] demonstrated that one-stop HCR could provide favorable mid-term outcomes in selected MVCAD patients, compared to PCI and traditional CABG, during 3-year follow-up. A study by Li et al. [17] showed that compared to off-pump coronary artery bypass grafting (OPCAB), one-stop HCR is effective, less invasive, and enables a shorter postoperative recovery time in MVCAD patients. Similar results can also be seen in the study of Song et al., which was conducted in patients with diabetes mellitus and MVCAD [16]. However, none of the published studies evaluated the optimal revascularization strategy for non-small non-LAD lesions during one-stop HCR, leaving this field under-researched.

DCB treatment represents a sustained anti-stenotic therapy with no permanent implantation. Its appearance and rapid development have changed the modern PCI strategy [6, 19]. According to the guidelines, DCB is recommended in the treatment of ISR, but it is beginning to have more indications in *de novo* coronary lesions [8, 19, 20]. For instance, the SPARTAN DCB study showed that compared with non-paclitaxel second-generation DES, DCB is a safe option for the treatment of *de novo* coronary artery disease in up to 5 years of follow-up [21]. The randomized REVELATION trial indicated that the DCB strategy was a safe and feasible strategy that was non-inferior to the DES strategy in patients with ST-segment elevation myocardial infarction (STEMI) [22]. Other studies also demonstrated the safety and effectiveness of DCB in the treatment of *de novo* coronary lesions, including small-vessel, large-vessel, calcified, and chronic total occlusion (CTO) coronary lesions [6, 23–26]. Nevertheless, the efficacy and safety of this novel revascularization strategy are poorly defined in comparison with DES for MVCAD patients undergoing one-stop HCR. Our study showed that the mid-term MACCE rate for all discharged participants was 17.4%, similar to the results of previous studies [3, 17]. After Kaplan-Meier curve analysis with the subsequent log-rank test, DCB therapy during one-stop HCR was associated with a significantly decreased incidence of mid-term MACCE compared to DES therapy (5.3% vs. 22%, respectively, log-rank $P = 0.02$). However, significant differences in the rate of each adverse prognostic event (all-cause death, re-hospitalization for MI, repeated revascularization, and stroke) were not observed for the DCB and DES groups (all *P*-values with no difference). This may be due to the relatively small sample size of the current study. Furthermore, after multivariable Cox proportional hazard analyses, EuroSCORE II (HR, 2.16; 95% CI, 1.09–3.51; $P = 0.04$) and number of DES (HR, 1.35; 95% CI, 1.02–2.08; $P = 0.04$) were two independent risk factors for mid-term MACCE, and DCB therapy during one-stop HCR was an independent predictor of mid-term MACCE-free survival (HR, 0.21; 95% CI, 0.06–0.91; $P = 0.04$). The results of our study suggested that DCB therapy might be the optimal revascularization strategy for non-small non-LAD lesions during one-stop HCR surgery.

The potential reasons that DCB therapy is more beneficial for the prognosis of one-stop HCR patients are as follows. First, DCB therapy can simplify the PCI procedure and shorten its duration, thus reducing the risk of coronary injury and ischemia [24]. For instance, DCB avoids the post-dilatation step of DES therapy and makes the

treatment of bifurcation lesions more convenient. Second, DCB makes antithrombotic management more flexible. The abnormal activation of platelet function and inflammatory state of the whole body related to surgery leads to blood coagulation abnormalities, which can increase the risk of both hemorrhage and thrombosis [27]. According to the current guidelines, the recommended shortest dual antiplatelet therapy (DAPT) duration in the treatment of CAD with DCB is one month, much shorter than that of DES [1]. As a result, it is easier for physicians to adjust antithrombotic therapy according to individual conditions of patients who received DCB treatment during one-stop HCR. Finally, in our experience, due to the drugs used for anesthesia and maintaining blood pressure, coronary arteries are prone to spasms during the one-stop HCR procedure, even with repeated intracoronary nitroglycerin injection. This may cause underestimation of the diameter of the diseased vessel segment followed by an inaccurate DES selection. Implantation of unsuitable DES may, finally, result in adverse prognosis, such as failure of target vessel revascularization, MI, or even cardiac death [11].

Taken together, although DCB therapy was not related to a significantly lower risk of in-hospital MACCE in MVCAD patients undergoing one-stop HCR, it was independently associated with an increased mid-term MACE-free survival rate. The findings of our study suggest that DCB therapy might be the optimal revascularization strategy for non-LAD lesions during one-stop HCR in patients with MVCAD. Still, individual assessment is necessary.

Limitations

First, since it was a single-center retrospective study, the sample size was relatively small, and the cause-and-effect relationship was unknown. The benefits of DCB therapy should be ideally verified in future large randomized controlled trials. Second, most of our study participants were male (75.2%); the results may lack generality to the full spectrum of the population. Finally, DCB is not applicable to all lesions; for large dissections after balloon dilatation or coronary calcification, stenting is still recommended.

CONCLUSIONS

In MVCAD patients undergoing one-stop HCR, DCB might be a better revascularization strategy for non-small non-LAD lesions compared to DES. DCB therapy was associated with a trend to lower in-hospital MACCE and was independently associated with a significantly reduced mid-term MACCE rate. Based on these findings, DCB therapy should be the preferred choice when interventional cardiologists treat non-LAD lesions during one-stop HCR in the MVCAD population.

Article information

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