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Research Article

Short-Term Outcomes of Total Arterial Revascularization Compared to Conventional Coronary Artery Bypass Graft in Patients with Multivessel Disease and Left Ventricular Dysfunction

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Background. Multivessel coronary artery disease (CAD) and left ventricular dysfunction (LVD) present challenges in CABG. We aimed to compare early outcomes of total arterial revascularization (TAR) versus conventional CABG in this high-risk population. *Methods*. This was a retrospective cohort study based on a single-center registry of patients who underwent isolated CABG for multivessel CAD and LVD between January 2014 and December 2022. Primary outcome was in-hospital mortality. Secondary outcomes were early complications, graft patency rate at 3 months, readmission rate within 6 months, and freedom from angina rate within 6 months. *Results*. A total of 112 cases were included in this study; 52 patients for TAR and 60 patients for conventional CABG. Both groups had comparable baselines and operative profiles. In-hospital mortality was similar between TAR and conventional CABG (2 deaths, 3.85% vs 4 deaths, 6.67%, $p = 0.810$). TAR had shorter ICU (3.5 vs 5 days, $p = 0.016$) and hospital stay (10.5 vs 12 days, $p = 0.007$). Other postoperative complications were similar. At 3 months, TAR had superior graft patency (91.7% vs 83.7%, $p = 0.034$) and lower 6-month readmission (TAR: 2/50, 4.0% vs. CR: 10/56, 17.9%, $p = 0.024$). Freedom from angina rate within 6 months was similar between the two groups (TAR: 43/50, 86.0% vs. CR: 42/56, 75.0%, $p = 0.240$). *Conclusion*. Our findings suggest that TAR may offer benefits in terms of shorter hospital stays, higher early graft patency, and lower readmission rates for patients with multivessel CAD and LVD. However, further research, particularly large-scale, randomized trials with longer follow-up periods, are needed to fully understand the long-term clinical outcomes and confirm these promising early results.

1. Introduction

Coronary artery disease (CAD) is a leading cause of ischemic heart disease, which is associated with increased morbidity and mortality [1]. Multivessel CAD reduces the blood and oxygen supply to the myocardium, resulting in ischemia, angina, and heart failure [2]. One of the most effective treatments for patients with multivessel CAD is coronary artery bypass grafting (CABG) [3], which restores the blood flow to the ischemic areas of the heart by using grafts to bypass the obstructed coronary arteries.

However, not all patients who undergo CABG have the same prognosis. A major factor that influences the outcomes of CABG is the presence of left ventricular dysfunction (LVD) [4]. LVD is a common complication of multivessel CAD, which impairs the cardiac output and increases the risk of adverse cardiac events [5]. LVD can be caused by previous myocardial infarction, chronic ischemia, or other factors that affect the structure and function of the left ventricle.

Therefore, it is important to optimize the surgical strategy for this high-risk population to improve their long-term outcomes. One specific technique of CABG that has gained interest in recent years is total arterial revascularization (TAR). TAR involves the use of only arterial grafts to perform CABG, without using any venous grafts.

Recent evidence has suggested that TAR may offer superior long-term patency rates and improved clinical outcomes in comparison to conventional revascularization (CR) [6, 7]. However, TAR is technically challenging and may pose higher operative risks [8], especially in patients with LVD. Moreover, few studies have examined the outcomes of TAR in patients with multivessel CAD and LVD.

In this paper, we aim to compare the early outcome of TAR and CR in patients with multivessel CAD and LVD who underwent isolated CABG at our institution between January 2014 and December 2022, ultimately providing valuable insights to guide optimal surgical decision-making in this challenging clinical context. We hypothesize that TAR would be associated with lower rates of postoperative complications, better graft patency, and improved cardiac function than conventional CABG in this high-risk population.

2. Methods

2.1. Study Design and Population. This was a retrospective cohort study based on a single-center registry of patients who underwent isolated CABG for multivessel CAD and LVD between January 2014 and December 2022 at our institution. Multivessel CAD was defined as the presence of at least two coronary arteries with more than 50% stenosis on coronary angiography. LVD was defined as a left ventricular ejection fraction (LVEF) of less than 40% on preoperative echocardiography. The exclusion criteria were as follows: (1) patients with combined ventricular wall aneurysm, ventricular septal perforation, chordae tendineae rupture, etc.; (2) patients with single-vessel disease, emergency or salvage CABG; (3) patients with prior cardiac surgical procedure; (4) concomitant valve surgery or other cardiac procedures. Perioperative insertion of an intra-aortic balloon pump (IABP) was indicated for patients with one or more of the following conditions: cardiogenic shock or ventricular failure that did not respond to medical therapy, unstable hemodynamics, persistent angina, ventricular arrhythmia, or severe left main coronary artery stenosis (>70%).

Patients were divided into two groups according to the type of revascularization: TAR (using total arterial revascularization strategy) or CR (using venous or mixed arterial and venous conduits). Total arterial revascularization was defined as the use of only arterial conduits (left internal thoracic, right internal thoracic, and/or radial arteries) for bypass grafts. Conventional CABG was defined as the use of ≥1 saphenous vein grafts in addition to arterial conduits [9]. Isolated single left internal thoracic artery (LITA) to left anterior descending (LAD) grafting alone did not meet criteria for TAR in this study. The study protocol was approved by the institutional review board, and the requirement for informed consent was waived.

2.2. Data Collection and Definitions. Data on baseline characteristics, operative details, postoperative complications, and follow-up outcomes were collected from electronic medical records, surgical databases, and telephone interviews. The primary outcome was in-hospital mortality. The secondary outcomes were early complications, freedom from angina rate within 6 months, graft patency rate at 3 months, and readmission rate within 6 months. Postoperative complications included respiratory complication, prolonged ventilation, low cardiac output syndrome (LCOS) requiring extracorporeal membrane oxygenation (ECMO), cardiocerebral events (myocardial infarction, and stroke), bleeding requiring reoperation, sternal wound infection, mediastinitis, acute kidney injury, and atrial fibrillation. In-hospital mortality was defined as death for any reason occurring within 30 days after the operation. Myocardial infarction was diagnosed based on the presence of typical symptoms, electrocardiographic changes, and elevated cardiac enzymes. Stroke was defined as a new focal neurological deficit lasting more than 24 hours and confirmed by imaging studies. Postoperative complications were defined according to the Society of Thoracic Surgeons criteria. Graft patency was assessed by computed tomography angiography (CTA) at 3 months after surgery. This was a routine practice in our institution for all patients who underwent CABG, regardless of the type of revascularization strategy. We defined graft occlusion as the absence of contrast opacification within the graft lumen, and graft stenosis as a reduction of more than 50% in the graft diameter. Follow-up data were obtained from outpatient clinic visits, telephone interviews, or linkage with the national death registry. The last follow-up date was June 30, 2023. Telephone interviews were conducted for patients who did not attend the clinic visits or who had missing data. Linkage with the national death registry was performed to verify the vital status of the patients and to identify any deaths that occurred outside the hospital. By using these methods, we were able to obtain complete follow-up data for all 112 patients within 6 months. The clinical indication for CABG was categorized as silent ischemia, stable angina, unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), or ST-segment elevation myocardial infarction (STEMI), based on the diagnosis at admission. Prior MI was defined as a history of myocardial infarction before the current admission.

2.3. Surgical Procedures and Postsurgical Treatment. We performed CABG under general anesthesia and median sternotomy in all patients. The choice of revascularization strategy was based on the surgeon's preference and the patient's characteristics: age, comorbidities, anatomical features (coronary-artery blockage location and extent, coronary-artery size, and availability of arteries and veins), and preference. We performed CABG using three different techniques: off-pump coronary artery bypass (OPCAB), on-pump coronary artery bypass (ONCAB), and ONCAB + cardioplegic arrest. The conduits of choice were left and right ITA, radial artery, and saphenous vein. The LITA was preferentially used to bypass the LAD artery when possible. If the LITA was unsuitable for use, the next choice was the radial artery. For other coronary territories, the right internal thoracic artery (RITA) and the radial artery were used preferentially when they were of adequate quality and diameter. In some cases, we used composite grafts, such as *T* grafts or snake grafts, to achieve maximal revascularization with fewer anastomoses or more arterial conduits. We decided the choice of conduits and target vessels based on our discretion and the quality and size of the vessels. The LITA was harvested in a pedicled fashion in all cases. The RITA was harvested as a short skeletonized conduit to preserve sternal blood flow and reduce the risk of spasm. The radial artery and saphenous vein graft were harvested using an open technique. The completeness of revascularization was assessed by comparing the number of diseased vessels (>70% stenosis) with the number of grafts performed. The number and location of grafts were determined by the extent and severity of CAD, the quality of target vessels, and the hemodynamic status of the patient.

In the OPCAB technique, we stabilized and positioned the heart using a tissue stabilizer device (Octopus, Medtronic) and a heart positioner device (Starfish or Urchin, Medtronic) and performed anastomoses on a beating heart. In the ONCAB technique, we established cardiopulmonary bypass using ascending aortic and a single right atrial cannula and performed anastomoses on a beating heart. In the ONCAB + cardioplegic arrest technique, we used the same method as in ONCAB, but we also induced cardiac arrest by delivering cold blood cardioplegia antegrade or retrograde.

All patients received standard postoperative care in the intensive care unit and the ward according to institutional protocols. Antiplatelet medicines, such as aspirin, were started within 6 hours after surgery and continued indefinitely. Other antiplatelet agents, such as clopidogrel, were added according to the discretion of the treating physician. Blood thinners, such as warfarin or rivaroxaban, were prescribed for some patients with concomitant atrial fibrillation, according to their CHA2DS2-VASc score and bleeding risk. Other medications, such as beta blockers, angiotensin-converting enzyme inhibitors, statins, and nitrates, were prescribed according to current guidelines.

2.4. Statistical Analysis. We expressed continuous variables as mean ± standard deviation or median (interquartile range [IQR]), depending on their distribution, and compared them using Student's *t*-test or Wilcoxon signed-rank test, respectively. We presented categorical variables as counts or percentages and compared them using chi-squared test or Fisher's exact test, as appropriate. We considered a two-sided p-value of <0.05 as statistically significant. We performed all analyses using SPSS v.26.0 (IBM SPSS Inc., Armonk, NY) and R 4.3.0.

3. Results

3.1. Baseline Characteristics. A total of 112 cases were included in this study, 52 patients for TAR and 60 patients for CR. The patients' baseline characteristics and comorbidities are shown in Table 1. The median age of the total sample was 56 years (IQR 49–73), and 68 patients (60.7%) were male. The most common clinical indication was unstable angina (42 patients, 37.5%), followed by stable angina (25 patients, 22.3%). The median LVEF was 35.4% (IQR 33.1–36.9), and the median EuroSCORE II was 2.965% (IQR 2.2–4.4175). The majority of the patients had three-vessel disease (88 patients, 78.6%) and were in NYHA class III (60 patients, 53.6%). There were no significant differences between the two groups in terms of age, sex, BMI, smoking history, diabetes, hypertension, clinical indication, prior myocardial infarction, chronic obstructive pulmonary disease, liver dysfunction, dialysis, peripheral vascular disease, cancer history, stroke history, arrhythmias, NYHA class, left main disease, three-vessel disease, two-vessel disease, left ventricular end-diastolic diameter, LVEF, and EuroSCORE II. The two groups were well matched and had similar risk profiles.

3.2. Operative Data and Early Outcomes. Table 2 shows the operative data and early outcomes of the study participants. The TAR group had a significantly longer operation duration than the CR group (TAR: 268.5 vs. CR: 220 minutes, $p = 0.004$). The characteristics of the CABG procedure (OPCAB, ONCAB, or ONCAB + cardioplegic arrest) were not significantly different between the two groups ($p = 0.180$). Of the 43 cases of ONCAB, 37 were elective and six were conversions from OPCAB due to hemodynamic instability, bleeding, or poor exposure. Of the 22 cases of ONCAB + cardioplegic arrest, 17 were elective and five were conversions from OPCAB for the same reasons. In the TAR group, 21 patients (40.4%) underwent OPCAB, 21 patients (32.7%) underwent ONCAB, and 17 patients (26.9%) underwent ONCAB + cardioplegic arrest. In the CR group, 26 patients (43.3%) underwent OPCAB, 26 patients (43.3%) underwent ONCAB, and 8 patients (13.3%) underwent ONCAB + cardioplegic arrest. The number of grafts and the rate of complete revascularization were also comparable between the two groups ($p = 0.837$ and $p = 0.807$, respectively). Complete revascularization was achieved in 37 patients (71.2%) in the TAR group and in 45 patients (75.0%) in the CR group. The reasons for incomplete revascularization were technical difficulties, poor distal targets, and lack of suitable conduits in some cases.

Intraoperative intra-aortic balloon pump (IABP) placement was required for two patients in the TAR group and one patient in the CR group. No patients in the TAR group and two patients in the CR group required postoperative IABP placement. The overall incidence of IABP usage did not differ significantly between the two groups (TAR: 3.85% vs. CR: 5.00%, $p = 0.869$). The TAR group had a significantly shorter intensive care unit (ICU) stay (TAR: 3.5 vs. CR: 5 days, $p = 0.016$) and hospital stay (TAR: 10.5 vs. CR: 12 days, $p = 0.007$) than the CR group. No cases of reexploration for bleeding or tamponade were observed in either group. Additionally, no sternal wound infections occurred after CABG surgery in either group. The hospital mortality rate was not significantly different between the two groups (TAR: 2 deaths, 3.85% vs. CR: 4 deaths, 6.67%, $p = 0.810$). To determine whether the mortality rates were clinically equivalent, an equivalence test was conducted using a 10% margin. The 90% confidence interval for the

Table 1: Comparison of patients' baseline demographic and clinical characteristics.

Variables[a]	Total sample ($n = 112$)	Patient groups TAR ($n = 52$)	CR ($n = 60$)	p value
Age (yr)	56 (49–73)	56 (49–63)	58 (50–65)	0.246
Male (n)	68	33	35	0.719
BMI (kg/m^2)	21.055 (18.605–24.7225)	21.39 (18.41–24.79)	22.3 (18.665–24.61)	0.510
Smoking history (n)	46	20	26	0.741
Diabetes (n)	62	30	32	0.785
Hypertension (n)	68	33	35	0.719
Clinical indication (n)				
Silent ischemia	17	7	10	
Stable angina	25	15	10	
Unstable angina	42	19	23	0.463
NSTEMI	17	8	9	
STEMI	11	3	8	
Prior MI (n)	18	9	9	0.941
COPD (n)	10	4	6	0.669
Liver dysfunction (n)	10	6	4	0.569
Dialysis (n)	4	3	1	0.845
Peripheral vascular disease	7	3	4	0.395
Cancer history (n)	5	2	3	0.768
Stroke history (n)	9	3	6	0.636
Arrhythmias (n)	9	3	6	0.599
NYHA class (n)				
I	19	8	11	
II	24	8	16	0.429
III	60	31	29	
IV	9	5	4	
Details of coronary artery disease				
Left main disease	13	5	8	0.751
Three-vessel disease	88	43	45	0.448
Two-vessel disease	24	9	15	
Preoperative echocardiographic data				
LVEDD (mm)	63.25 ± 5.04	63.06 ± 4.96	63.42 ± 5.15	0.705
LVEF (%)	35.4 (33.1–36.9)	35.5 (33.1–37.2)	35.4 (33.475–36.825)	0.845
EuroSCORE II (%)	2.965 (2.2–4.4175)	2.85 (2.0075–4.4175)	3.04 (2.255–4.3775)	0.279

TAR, total arterial revascularization; CR, conventional revascularization; BMI, body mass index; NSTEMI, non-ST-segment elevation myocardial infarction; STEMI, ST-segment elevation myocardial infarction; MI, myocardial infarction; COPD, chronic obstructive pulmonary disease; NYHA, New York Heart Association; LVEDD, left ventricular end-diastolic diameter; LVEF, left ventricular ejection fraction. [a]Non-normally distributed variables are presented as the median (interquartile range (IQR)) and categorical data as number.

mortality rate difference between groups was −7.3% to 4.6%, falling entirely within the equivalence region. The rates of early complications, such as respiratory complication, prolonged ventilation, LCOS requiring ECMO, and cardiocerebral events, were also similar between the two groups ($p > 0.05$ for all).

Of the 112 participants included in this study, none were lost to follow-up within 6 months. The use of dual antiplatelet therapy within 6 months was similar between the two groups (TAR: 47/50, 94.0% vs. CR: 52/56, 92.9%, $p = 0.813$). The use of anticoagulants within 6 months was also comparable between the two groups (TAR: 2/50, 3.9% vs. CR: 3/56, 5.0%, $p = 0.742$). Freedom from angina rate within 6 months was similar between the two groups (TAR: 43/50, 86.0% vs. CR: 42/56, 75.0%, $p = 0.240$). The graft patency rate at 3 months was significantly higher in the TAR group than in the CR group (TAR: 91.7% vs. CR: 83.7%, $p = 0.034$). The readmission rate within 6 months was significantly lower in the TAR group than in the CR group (TAR: 4.0% vs. CR: 17.9%, $p = 0.024$). The readmission rate within 6 months was significantly lower in the TAR group than in the CR group (TAR: 2/50, 4.0% vs. CR: 10/56, 17.9%, $p = 0.011$). The reasons for readmission were as follows: heart failure (TAR: 1, CR: 2), pulmonary infection (TAR: 2, CR: 2), atrial fibrillation (TAR: 1, CR: 2), stroke (TAR: 0, CR: 1), and angina (TAR: 0, CR: 1). No patient required repeat percutaneous or surgical intervention within 6 months. However, one patient in the CR group was readmitted for angina and three patients (one in the TAR group and two in the CR group) were readmitted for heart failure, both of which were managed medically.

4. Discussion

CABG remains one of the most effective treatments for patients with multivessel CAD and LVD [5]. However, the optimal revascularization strategy in this high-risk patient population is still a matter of debate [10, 11]. In this study, we compared the early outcomes of TAR versus CR in patients with multivessel CAD and LVD. The main findings

Table 2: Operative data and postoperative in-hospital outcomes.

Variables[a]	Total sample ($n = 112$)	Patient groups		p value
		TAR ($n = 52$)	CR ($n = 60$)	
Operation duration (minutes)	235 (213.75–273.25)	268.5 (236.75–287.75)	220 (202.75–235.25)	0.004
Characteristics of CABG procedure				0.180
OPCAB	47	21	26	
ONCAB	43	17	26	
ONCAB + cardioplegic arrest	22	14	8	
Number of grafts				0.837
1	6	2	4[b]	
2	15	8	7	
3	44	19	25	
4	27	12	15	
5	26	11	9	
Complete revascularization	82	37	45	0.807
Intensive care unit stay (days)	4 (2.75–6)	3.5 (2–5)	5 (3–8)	0.016
Hospital stay (days)	11.5 (10–14)	10.5 (9–13)	12 (10.75–14.25)	0.007
Hospital mortality	5.36%	3.85%	6.67%	0.810
Early complications				
Respiratory complication (n)	25	13	12	0.685
Prolonged ventilation (n)	13	4	9	0.364
Blood loss (ml, first 24 h)	220 (143.75–316.25)	237.5 (178.75–322.5)	200 (128.75–252.5)	0.046
LCOS requiring ECMO (n)	3	1	2	0.645
Cardiocerebral events (n)	7	3	4	0.845
Freedom from angina within 6 months	80.2% (85/116)	86.0% (43/50)	75.0% (42/56)	0.240
Graft patency rate at 3 months	87.6%	91.7%	83.7%	0.034
Readmission within 6 months	11.3% (12/106)	4.0% (2/50)	17.9% (10/56)	0.024

TAR, total arterial revascularization; CR, conventional revascularization; CABG, coronary artery bypass grafting; OPCAB, off-pump coronary artery bypass; ONCAB, on-pump coronary artery bypass; LCOS: low cardiac output syndrome; ECMO: extracorporeal membrane oxygenation. [a]Non-normally distributed variables are presented as the median (interquartile range (IQR)) and categorical data as number. [b]Of the 4 patients in the CR group who received a single graft, 2 had a LIMA to LAD graft, and 2 had a single vein graft.

of this study are as follows: (1) TAR was feasible and safe in patients with multivessel CAD and LVD, without increasing the operative risk or hospital mortality; (2) TAR was associated with shorter ICU and hospital stay, higher early graft patency rate, and lower readmission rate within the first 6 months postprocedure than conventional CABG.

The benefits of TAR over conventional CABG have been well established in previous studies. TAR has been shown to improve long-term survival, reduce the need for repeat revascularization, and lower the incidence of cardiac events in patients with multivessel CAD [7, 12]. The superior outcomes of TAR are mainly attributed to the higher patency rates of arterial grafts compared to venous grafts [13]. Arterial grafts have better resistance to atherosclerosis, thrombosis, and spasm than venous grafts, and they also have better endothelial function and vasoreactivity. Moreover, arterial grafts can provide more physiological flow patterns and adapt to changes in coronary flow demand [14]. Our study supports these findings, as we observed a significantly higher graft patency rate at 3 months (91.7% vs. 83.7%, $p = 0.034$) and a similar freedom from angina rate within 6 months (86.0% vs. 75.0%, $p = 0.240$) in the TAR group compared to the CR group.

However, several concerns have limited the application of TAR in patients with LVD. TAR is more technically demanding and time-consuming than CR, especially when using multiple arterial conduits or performing off-pump surgery. Moreover, TAR may increase the risk of sternal wound infection or mediastinitis, particularly in patients with diabetes, obesity, or chronic lung disease [15]. Therefore, it is important to evaluate the feasibility, safety, and efficacy of TAR in patients with multivessel CAD and LVD. To our knowledge, this is the first study to compare the early outcomes of TAR and CR in this high-risk population. We found that TAR was feasible and safe in patients with multivessel CAD and LVD, without increasing the operative risk or hospital mortality. The TAR group had a longer operation duration than the CR group. The use of arterial grafts in TAR requires meticulous and time-consuming anastomosis techniques, which might contribute to the longer operation time. However, this did not translate into higher rates of postoperative complications or mortality. On the contrary, we found that TAR was associated with shorter ICU and hospital stay. This finding may be attributed to the superior hemodynamic stability, lower incidence of postoperative complications, and potentially fewer wound-related issues with the absence of venous graft harvesting sites, as suggested by previous studies [16, 17]. Shorter hospital stays not only reduce the economic burden on patients and healthcare systems but also have implications for patient recovery and overall satisfaction.

A notable finding in our study was the higher graft patency rate observed in the TAR group at 3 months postsurgery than the CR group. The use of arterial grafts in TAR might contribute to the improved graft patency rates, as arterial conduits have been associated with better long-term patency compared to venous grafts [18]. Although it is challenging to draw definitive conclusions from early graft patency data, these results are promising and warrant further investigation in long-term follow-up studies to assess the impact of graft patency on clinical outcomes. While the superior graft patency rate of TAR observed in our study is encouraging, it is important to acknowledge the lack of a significant difference in freedom from angina within 6 months between the two groups. This may be due to several reasons, such as the small sample size, the short follow-up period, and the multifactorial nature of angina symptoms in patients with LVD. Long-term studies are therefore necessary to assess the full impact of graft patency on symptom relief.

Another important observation in our study was the lower readmission rate within 6 months in the TAR group than the CR group (4.0% vs. 17.9%, $p = 0.024$). Reduced readmission rates could be attributed to the superior graft patency observed in the TAR group, leading to fewer ischemic events such as angina, myocardial infarction, or heart failure requiring hospitalization [19]. However, it is essential to consider that readmission rates can be influenced by various factors, such as patient compliance, lifestyle modifications, and medical management, and thus, the true impact of TAR on readmission rates requires careful evaluation in larger, prospective studies [20, 21].

However, one third of the patients in the TAR group and 25% in the CR group had incomplete revascularization. This rate was higher than expected, but we would like to emphasize that our decision to perform incomplete revascularization was not arbitrary, but rather based on several factors, such as technical difficulties, poor distal targets, or lack of suitable conduits. Moreover, TAR was associated with a higher graft patency rate than CR (91.7% vs. 83.7%, $p = 0.034$), which might have mitigated some of the adverse effects of incomplete revascularization. None of our patients required repeat percutaneous or surgical intervention because most of them were asymptomatic or had mild angina at the 6-month follow-up, which might be attributed to improved medical therapy, collateral circulation, or myocardial hibernation.

Besides graft patency and angina relief, another potential benefit of TAR is the improvement of left ventricular function, which may affect the prognosis and quality of life of patients with multivessel CAD and LVD [22]. We did not measure the postoperative LVEF or other parameters of left ventricular function because this study was mainly focused on some clinical outcomes, such as mortality, complications, graft patency, and angina relief. We considered these outcomes to be more relevant and important for patients with multivessel CAD and LVD who underwent CABG. However, we recognize that left ventricular function is also a crucial outcome that may affect the prognosis and quality of life of these patients [23]. Therefore, we plan to investigate the effect of TAR on left ventricular recovery in our future studies.

The mortality rates in our study were higher than those predicted by EuroSCORE II (TAR: 3.85% vs. 2.85%, CR: 6.67% vs. 3.04%). This discrepancy could be attributed to some factors that the EuroSCORE model did not adequately account for in this population, such as small coronary artery size, diffuse coronary artery disease, and incomplete revascularization.

5. Limitations

It is important to note that our study has several limitations. First, this was a retrospective cohort study from a single center, which may limit the generalizability of the findings. The small sample size may have reduced the statistical power to detect a significant difference in in-hospital mortality between TAR and CR. Therefore, our study was underpowered and the lack of difference could be a result of a type II error. Multicenter, randomized controlled trials with larger sample sizes and longer follow-up durations are needed to confirm our results and assess potential long-term benefits of TAR. Second, the choice of revascularization strategy was not randomized but rather based on the surgeon's preference and patient characteristics, introducing potential selection bias. Randomized controlled trials could address this limitation and provide more robust evidence on the benefits of TAR in this patient population. Third, we did not have data on the subtype of prior myocardial infarction (STEMI vs. NSTEMI). This may have provided further insights into the patients' ischemic burden and risk profiles. Fourth, we did not examine if incomplete revascularization contributed to the cases of readmission for angina and heart failure. Future studies should investigate the association between completeness of revascularization and adverse cardiac events requiring hospitalization. Additionally, while the early outcomes of TAR are promising, long-term data regarding left ventricular recovery, survival, and quality of life are needed to fully understand the potential benefits of this approach in patients with multivessel CAD and LVD.

6. Conclusion

In conclusion, our study provides valuable insights into the early outcomes of total arterial revascularization compared to conventional CABG in patients with multivessel CAD and LVD. Both strategies demonstrated similar mortality rates and early complications, indicating the safety and efficacy of both approaches. TAR was associated with shorter ICU and hospital stay. Notably, TAR showed potential advantages in terms of graft patency and reduced readmission rates within 6 months, suggesting possible improved long-term outcomes. Further larger-scale, prospective studies with longer follow-up are warranted to validate these findings and determine the true impact of TAR on long-term clinical outcomes in this high-risk patient population.

Data Availability

All the data generated or analyzed during this study are included within this article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Xiaofu Dai conceptualized the study, drafted and approved the article, and performed the statistical analysis. Zhiqin Lin performed critical revision of the article, approval of the article, statistical analysis, funding acquisition, and data collection. Zheng Xu performed critical revision of the article, approval of the article, statistical analysis, funding acquisiton, and data collection. Liangwan Chen performed the critical revision of the article, approval of the article, statistical analysis, funding acquistion, and data collection.

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