I. Introduction

According to the annual changes in the mortality rate in Japan presented in the 2013 demographic statistics of the Ministry of Health, Labour and Welfare, the top cause of death in Japan is heart and cerebrovascular disease associated with atherosclerosis, and there is a high frequency of concomitant multiarterial atherosclerotic disease in patients diagnosed with coronary artery disease. The number of cardiovascular surgery performed on elderly patients has also been increasing, and multiarterial atherosclerotic disease, which increases with increasing age, cannot be ignored in the present situation. Against such a background, it is considered that coronary artery bypass grafting (CABG) on complex and 3-branch lesions in ischemic heart disease is associated with a high rate of atherosclerotic complications like carotid artery disease. In this study, we examined the presence of concomitant multiarterial atherosclerotic disease and atherosclerosis-related factors in recent cases of CABG and the perioperative and late-phase results to investigate if multiarterial atherosclerotic disease and atherosclerosis-related factors have an impact on the results of CABG.

II. Subjects and Method

The subjects were 101 consecutive cases undergoing isolated CABG at our hospital between October 2011 and July 2015. Preoperatively, atherosclerosis-related factors were measured and the presence or absence of multiarterial atherosclerotic disease was confirmed by diagnostic imaging in all cases, and the impact was retrospectively investigated. There were 96 cases in the uneventful discharge group and 5 in the operative death (death within 30 days) group, and concomitant multiarterial atherosclerotic disease was present in 69 cases (72%) in the uneventful discharge group and 3 cases (60%) in the operative death group, respectively. In the operative death group, levels of glycated hemoglobin and triglycerides (TG), as well as the rate of hemodialysis, were significantly high. The most common concomitant atherosclerotic disease was brain lesions, and advanced calcification of the aorta and iliac arteries was also seen, but only one case of death was due to multiarterial atherosclerotic disease. Nine cases developed partial occlusion of the graft, and TG was significantly higher in this group compared to the group with completely patent grafts. Conclusion: We consider that it is possible to maintain good results of coronary artery bypass grafting in the presence of concomitant multiarterial atherosclerotic disease by performing preoperative systemic tests to be fully aware of the preoperative situation, and to take measures against complications. It is also necessary to strictly manage atherosclerosis-related factors.

KEY WORDS: atherosclerosis-related factors, coronary artery bypass grafting, multiarterial atherosclerotic disease
tively investigated. Examined atherosclerosis-related factors were hypertension, smoking, and the presence or absence of hemodialysis; blood-related factors were total cholesterol (T-CHO), triglycerides (TG), high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), glycated hemoglobin (HbA1c), serum creatinine (S-Cr), and estimated glomerular filtration rate (eGFR); and diagnostic imaging-related factors were head magnetic resonance imaging (MRI), magnetic resonance angiography (MRA), carotid artery echography, thoracic computed tomography (CT), ankle brachial index (ABI), and echography of the lower limb vessels. Atherosclerotic lesions were considered significant if they met the following criteria: significant stenosis was considered as ≥ 50% stenosis of intracerebral blood vessels and ≥ 70% stenosis of the carotid arteries, significant aortic aneurysm was considered as maximum short diameter of ≥ 60 mm for the thoracic aorta, ≥ 50 mm for the abdominal aorta, and ≥ 30 mm for the iliac arteries, while significant stenosis of lower limb arteries was considered as ≥ 75% stenosis.

Among the total of 101 cases, 72 cases (71%) had some kind of concomitant multiarterial atherosclerotic disease, and according to the study method used in this study, all cases were divided into the uneventful discharge group and the operative death group (death within 30 days), while the uneventful discharge group was subdivided into the survival group and the late-phase death group for comparison. The uneventful discharge group was also divided into the completely patent bypass graft group and the partially occluded graft group for comparison (Fig. 1).

III. Statistical analysis

All of the numerical data are expressed as mean ± standard deviation. The Mann-Whitney U-test was used for comparison of two groups of numerical data, and Fisher’s exact test was used to compare calculated data. The log-rank test was used to compare survival curves. Especially for comparison in the acute phase, combination with a generalized Wilcoxon test was used. The results of the tests were considered significant if P < 0.05, and for results that were not significant, P < 0.1 was considered to indicate the existence of a trend.

IV. Results

Mean age was 68 ± 9 years; male-to-female ratio was 84:17; the surgical procedure was on pump (beating) in 21 cases, on pump (beating) in 7 cases, and off pump coronary artery bypass (OPCAB) in 73 cases; auxiliary intra-aortic balloon pumping (IABP) was used in 76% of cases, the number of bypass branches was 2.9 ± 1.0; diabetes mellitus (DM) was present in 46% (HbA1c, 7.9 ± 1.5%), hypertension (HT) in 78%, dyslipidemia (DL) in 32%, smoking in 64%, and hemodialysis (HD) in 19%. Intracranial lesions consisted of infarction in 51% and significant cerebrovascular stenosis in 20%, and carotid artery lesions consisted of significant stenosis in 20% and occlusion in 3%. Aortic lesions were advanced calcification in 48%, inability to cut off at the proximal anastomosis in 8%, and aneurysm formation in 0% for the thoracic aorta, advanced calcification in 75% and aneurysm formation in 10% for the abdominal aorta, and advanced calcification in 73% and aneurysm formation in 4% for the iliac arteries. Lower limb artery lesions were significant stenosis in 52%, occlusion in 67%, and severe lower limb ischemia in 6%. Pre-CABG treatment for atherosclerotic lesions was superficial temporal artery middle cerebral artery anastomosis bypass (STA-MCA bypass) in 1 case, carotid endarterectomy (CEA) in 1 case, synthetic graft replacement for abdominal aortic aneurysm in 1 case, endovascular aneurysmal repair (EVAR) in 3 cases, and femoropopliteal bypass (F-P bypass) in 1 case. Post-CABG treatment was synthetic graft replacement for abdominal aortic aneurysm in 3 cases. Postoperative complications were brain infarction in 1 case and mediastinitis in 4 cases.

1. Comparison of the uneventful discharge group and the operative death group

There were 96 cases in the uneventful discharge group and 5 cases in the operative death group. Concomitant multiarterial atherosclerotic disease was present in 69 cases (72%) and 3 cases (60%), respectively. There were no significant differences in preoperative cardiac function, left-ventricular remodeling, and the number of revascularizations, but HbA1c was high (6.7 ± 1.5 vs 8.5 ± 1.3%, P=0.0089), TG was high (127.6 ± 61.8 vs 193.0 ± 30.4 mg/dl, P=0.0122), and HD rate was high (16.7 vs 60.0%, P=0.0448) in the operative death group (Table 1). Investigation of the presence or absence of atherosclerotic disease by site in the two groups showed that there were many intracerebral lesions as well as advanced calcifications in the aorta and iliac arteries in both groups. There were no cases of thoracic aortic aneurysm, and abdominal aortic aneurysm was found in 12.9% and
and the partially occluded graft group

Postoperative graft contrast was performed in all cases, and partial occlusion of the graft was found in 9 cases. Comparison of the completely patent graft group (87 cases) and the partially occluded graft group (9 cases) showed that TG was significantly higher in the occlusion group (176.0 ± 75.3 vs 122.5 ± 57.8 mg/dl, P=0.0496) (Table 3).

4. Comparison of the survival group and the late-phase death group in the uneventful discharge group

We subdivided the uneventful discharge group into the survival group of 88 cases and the late-phase death group of 8 cases for comparison. Although the difference was not significant, the late-phase death group tended to have more elderly cases and a higher HD rate than the survival group (14.8 vs 37.5%) (Table 4). Investigation of atherosclerotic disease at each site did not show a significant difference between the groups (72 vs 75%), but the rate of concomitant brain infarction/hemorrhage tended to be

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Table 1: Comparison of atherosclerosis-related factors, cardiac function, and revascularization between the uneventful discharge group and the operative death group

|                     | Uneventful discharge (N=96) | Operative death (N=5) | P value |
|---------------------|-----------------------------|-----------------------|---------|
| Age (y)             | 68.1 ± 9.2                  | 62.4 ± 8.8            | 0.1304  |
| Gender (M/F)        | 79/17                       | 5/0                   | 0.5859  |
| Smoking             | 64.6%                       | 60.0%                 | 1.0000  |
| Hypertension        | 76%                         | 100%                  | 0.5858  |
| HbA1c (%)           | 6.7 ± 1.5                   | 8.5 ± 1.3             | 0.0089* |
| Insulin therapy     | 16.7%                       | 20.0%                 | 1.0000  |
| TG (mg/dl)          | 127.6 ± 61.8                | 193 ± 30.4            | 0.0122* |
| T-CHO (mg/dl)       | 178.5 ± 34.9                | 161.0 ± 18.5          | 0.2163  |
| LDL (mg/dl)         | 109.0 ± 29.9                | 107.8 ± 47.6          | 0.5087  |
| HDL (mg/dl)         | 50.1 ± 12.7                 | 65.2 ± 52.3           | 0.4576  |
| LDL/HDL             | 2.3 ± 0.9                   | 2.3 ± 1.0             | 0.8193  |
| S-Cr (mg/dl)        | 2.4 ± 3.75                  | 6.96 ± 5.2            | 0.2941  |
| eGFR (ml/min/1.73m²)| 53.2 ± 29.2                 | 34.2 ± 36.6           | 0.4338  |
| HD                  | 16.70%                      | 60.00%                | 0.0448* |
| CAVI-R              | 8.7 ± 1.9                   | 8.4 ± 2.8             | 0.8476  |
| CAVI-L              | 8.5 ± 2.1                   | 8.4 ± 2.8             | 0.9362  |
| LVEF (%)            | 59.5 ± 13.2                 | 51.4 ± 8.7            | 0.1885  |
| LVDD (mm)           | 51.2 ± 0.7                  | 56.3 ± 1.2            | 0.2289  |
| LVEDs (mm)          | 34.9 ± 0.8                  | 41.6 ± 1.0            | 0.1270  |
| MR (degree)         | 0.9 ± 0.7                   | 0.8 ± 0.8             | 0.6170  |
| CAB number          | 2.9 ± 0.9                   | 2.9 ± 1.2             | 0.5709  |
| IABP (%)            | 77.1                        | 60.0                  | 0.5900  |

M/F: male/female, TG: triglyceride, T-CHO: total cholesterol, LDL: low density lipoprotein cholesterol, HDL: high density lipoprotein cholesterol, S-Cr: serum creatinine, eGFR: estimated glomerular filtration rate, HD: hemodialysis, CAVI: cardio-ankle vascular index, R: right, L: left, LVEF: left ventricular ejection fraction, LVDd: left ventricular end-diastolic diameter, LVEDs: left ventricular end-systolic diameter, MR: mitral valve regurgitation, CAB: coronary artery bypass, IABP: intra-aortic balloon pumping, *: significant
higher in the late-phase death group than in the uneventful discharge group, while other factors were similar between the groups (Table 5).

5. Investigation of cases of late-phase death

Cases of late-phase death tended to be elderly, all were male, and cardiac function was good in all but 1 case, and complete revascularization was performed in all cases, in whom it was confirmed by postoperative graft imaging that the grafts were patent. There were no particular characteristics of atherosclerosis-related factors, but the rate of HD was high. The cause of death varied, but there were no obvious cardiovascular-related deaths.

6. Survival curves

The overall 4-year survival rate was 82% (Fig. 2a). The respective investigations suggested that the atherosclerosis-related factors of DM, DL, and HD had a significant impact on the prognosis of CABG in the operative death group and the late-phase death group, and survival curves were therefore investigated.

In the DM group, acute phase survival tended to be lower, but late-phase survival did not show a significant difference with the non-DM group (Fig. 2b). The DL group also showed lower acute phase survival, but no significant difference in late-phase survival (Fig. 2c). The HD group showed a significant lower survival both in the acute and the late phases, and the 4-year survival was a poor 60% (Fig. 2d).

7. Investigation of cases who required treatment for multia
terial atherosclerotic disease before and after CABG

Pre-CABG treatment for atherosclerotic disease, in cases considered to have critical brain ischemia based on preoperative N-isopropyl-p-[123]I iodoamphetamine single-photon emission computed tomography (123I-IMP SPECT), was STA-MCA bypass in 1 case, CEA in 1 case, synthetic graft replacement for abdominal aortic aneurysm in 1 case, EVAR in 3 cases, and F-P bypass in 1 case. Post-CABG treatment was synthetic graft replacement for abdominal aortic aneurysm in 3 cases. The historical background and the form of arterial aneurysm also play a role, but the initial treatment of the 2 cases of abdominal aortic aneurysm rupture was synthetic graft replacement and EVAR in 1 case each, and concerning the 5 cases of elective surgery, if there was a morphological indication for EVAR, preference was given to EVAR, and if synthetic graft replacement was indicated, preference was given to CABG; however, in 1 case of unstable angina, EVAR was simultaneously performed (Table 6).

V. Discussion

Based on a report of the Reduction of Atherothrombosis for Continued Health (REACH) Registry, among the 67,888 registered patients, multia
terial atherosclerotic disease involves concomitant ischemic heart disease and carotid artery disease in 8.4%, concomitant ischemic heart disease and peripheral artery disease in 4.7%, and concomitant ischemic heart disease, carotid artery disease, and peripheral artery disease in 1.6%[2]. However, patients with ischemic heart disease with complex coronary artery lesions or 3-branch lesions have a high rate of concomitant atherosclerotic disease, and the rate of concomitant atherosclerotic disease in carotid artery lesions is 36.0%[1]. The impact of multia
terial atherosclerotic disease on cases of CABG depends on the severity of the disease, but there are not many patients who unavoidably have to undergo simultaneous surgery for con-
comitant disease, and if all possible measures are applied, the course is uncomplicated and it may be necessary to perform surgery at a later stage. We investigated the presence of concomitant multiarterial atherosclerotic disease in our CABG patients, and examined its impact this time.

1. Ascending arch aortic aneurysm

In this study, there were no cases of concomitant ascending arch aortic aneurysm. In case of thoracic aortic aneurysm, especially ascending arch aortic aneurysm, for which simultaneous surgery is indicated, there is often no choice but to perform surgery simultaneously, and it may be necessary to perform percutaneous transluminal coronary angioplasty preoperatively depending on the patient background and lesion. In many reports of simultaneous surgery for aortic arch aneurysm and CABG\(^1\),\(^4\), coronary artery lesions are complications of aortic arch lesions, and there are actually some differences with cases who have to undergo CABG with concomitant aortic lesions. It seems difficult to debate the results of simultaneous aortic arch aneurysm surgery and CABG using total arterial grafting for so-called multiple branch lesions and impaired left heart function, compared with the results of simultaneous aortic arch aneurysm surgery and CABG of 1 or 2 branches. It has also been reported that the incidence of postoperative brain infarction was high with simultaneous aortic arch surgery, and that late-phase prognosis was poor due to the invasiveness of the surgery and the progression of the atherosclerosis\(^3\). It can thus be seen that there are still many problems concerning concomitant ascending aortic arch aneurysm.

2. Descending thoracic and abdominal aortic aneurysms

Endovascular surgery is an effective therapeutic method for aortic disease, especially dilated lesions like arterial aneurysm. In Japan, EVAR is performed in 47.6% of cases of abdominal aortic aneurysm\(^5\), and thoracic endovascular surgery is performed in up to 32.6% of thoracic aortic aneurysm\(^6\), and it is considered that the combination of these procedures with CABG contributes to improving the results.

3. Advanced aortic calcification

In case of advanced ascending aortic calcification, it is effective to use an automated proximal graft anastomosis device besides “Aorta no touch.” We have reported 28 cases of CABG us-

![Fig. 2](image-url)
Tables 3 and 4 Comparison of atherosclerosis-related factors, cardiac function, and revascularization between the completely patent graft group and the partially occluded graft group. 

| Table 3 | | Table 4 | | 
|---|---|---|---| 
| **Completely patent bypass graft (N=87)** | **Partially occluded bypass graft (N=9)** | **Survival (N=88)** | **Late-phase death (N=8)** | 
| **P value** | | | | 
| **Age (y)** | 68.3 ± 8.8 | 66.2 ± 11.9 | 0.5627 | 
| Gender (M/F) | 72/15 | 7/2 | 0.6579 | 
| Smoking | 35.6% | 66.6% | 1.0000 | 
| Hypertension | 58.3% | 66.6% | 0.4436 | 
| HbA1c (%) | 6.7 ± 1.5 | 6.9 ± 1.1 | 0.3104 | 
| TG (mg/dl) | 122.5 ± 57.8 | 176.0 ± 75.3 | 0.0496* | 
| T-CHO (mg/dl) | 177.2 ± 34.8 | 189.0 ± 33.9 | 0.4204 | 
| LDL (mg/dl) | 109.4 ± 29.9 | 105.1 ± 29.3 | 0.5410 | 
| HDL (mg/dl) | 49.6 ± 12.5 | 54.3 ± 13.4 | 0.3081 | 
| LDL/HDL | 2.3 ± 0.9 | 2.0 ± 0.5 | 0.2317 | 
| HD | 18.4% | 0% | 0.3483 | 
| CAVI-R | 8.8 ± 1.9 | 7.7 ± 1.4 | 0.1654 | 
| CAVI-L | 8.5 ± 2.2 | 8.1 ± 1.2 | 0.6252 | 
| LVEF(%) | 59.4 ± 13.5 | 60.5 ± 9.8 | 0.8588 | 
| LVDd(mm) | 51.2 ± 0.7 | 51.0 ± 0.4 | 0.9436 | 
| LVDs(mm) | 34.9 ± 0.8 | 34.1 ± 0.4 | 0.7046 | 
| MR(degree) | 0.9 ± 0.7 | 0.7 ± 0.5 | 0.2987 | 
| CAB number | 2.9 ± 0.9 | 2.9 ± 1.2 | 0.6293 | 
| IABP | 77.0% | 77.8% | 1.0000 | 
| M/F: male/female, TG: triglyceride, T-CHO: total cholesterol, LDL: low density lipoprotein cholesterol, HDL: high density lipoprotein cholesterol, HD: hemodialysis, CAVI: cardio-ankle vascular index, R: right, L: left, LVEF: left ventricular ejection fraction, LVDd: left ventricular end-diastolic diameter, LVDs: left ventricular end-systolic diameter, MR: mitral valve regurgitation, CAB: coronary artery bypass, IABP: intra-aortic balloon pumping, *: significant | | M/F: male/female, TG: triglyceride, T-CHO: total cholesterol, LDL: low density lipoprotein cholesterol, HDL: high density lipoprotein cholesterol, S-Cr: serum creatinine, eGFR: estimated glomerular filtration rate, HD: hemodialysis, CAVI: cardio-ankle vascular index, R: right, L: left, LVEF: left ventricular ejection fraction, LVDd: left ventricular end-diastolic diameter, LVDs: left ventricular end-systolic diameter, MR: mitral valve regurgitation, CAB: coronary artery bypass, IABP: intra-aortic balloon pumping, *: significant | 

The onset of brain complications in calcified CABG cases did not show a significant difference in comparison of segmental aortic cut-off and use of an auxiliary measure. We used IABP or pulsatile extracorporeal circulation as perioperative measures to prevent organ ischemia. We used IABP or pulsatile extracorporeal circulation in all 136 cases undergoing isolated CABG with advanced carotid artery stenosis, and chronic kidney failure due to renal arteriosclerosis, and could report the absence of cases with serious complications or postoperative death. Especially for carotid artery lesions, which cause serious complications, careful measures are essential. In general, it is often reported that there are no changes in mean cerebral blood flow when IABP is applied, and Cheung et al. have also reported that although the cerebrovascular pressure wave form, the mean cerebral blood flow was not affected in a study of auxiliary perioperative IABP use in patients undergoing open-heart surgery. In many cases, it was considered that cerebral blood flow was secondarily maintained as a result of stabilization of systemic hemodynamics due to the use of IABP. Concerning more critical cases, Tanaka
comitant critical limb ischemia, it is possible to avoid lower limb ischemia associated with extracorporeal circulation and IABP placement by performing simultaneous percutaneous transluminal angioplasty at the level of the iliac and femoral arteries.

6. Atherosclerosis-related factors

The investigation of the operative death group and the late-phase death group showed significantly high levels of HbA1c and TG, and a high HD rate of 60%, which were significantly different. It is considered that management of these atherosclerosis-related factors has an impact on the results of CABG in the presence of concomitant multiarterial atherosclerotic disease. Perioperative blood sugar control is extremely important in DM patients, and by setting the perioperative blood sugar control at ≤200 mg/dl in a study of 136 cases undergoing only CABG, we succeeded in suppressing bacterial infection and decreasing the number of days in the ICU, and thus reported the extreme impor-

et al. reported that it is considered useful for determination of surgical interventions to improve cerebral blood flow by evaluating detection using cerebral blood flow SPECT in the Stage II field in the stereotactic extraction estimation-Japanese EC-IC bypass study (SEE-JET)\(^2\).

5. Peripheral arterial disease

In this study, the rate of concomitant multiarterial atherosclerotic disease in all cases was high at 71%, but there was only one case of death due to multiarterial atherosclerotic disease. In cases with Leriche syndrome and other aortic and iliac artery occlusion lesions, internal thoracic artery collateral circulation was only found in 6.3%, a relatively small number\(^3\). In the above case of death, emergency surgery was performed for acute myocardial infarction without adequate preoperative tests, and use of the internal thoracic artery led to severe lower limb ischemia with sepsis and the development of necrosis\(^4\). In case of concomitant critical limb ischemia, it is possible to avoid lower limb ischemia associated with extracorporeal circulation and IABP placement by performing simultaneous percutaneous transluminal angioplasty at the level of the iliac and femoral arteries.

| Table 5 | Comparison of multiarterial atherosclerotic disease between the survival group and the late-phase death group |
|---------|--------------------------------------------------------------------------------------------------------|
| site    | lesion                                      | Survival (N=88) | Late-phase death (N=8) | P value     |
|---------|-------------------------------------------|-----------------|----------------------|------------|
| intracranial | Stroke arterial stenosis                  | 53.20%         | 71.40%               | 0.3309     |
|         | arterial occlusion                        | 21.60%         | 14.30%               | 0.8856     |
| carotid artery | arterial occlusion stenosis              | 26.70%         | 0%                   | 0.8965     |
|         | Max IMT(mm)                               | 2.9 ± 1.2      | 2.7 ± 0.8            | 0.8546     |
| thoracic aorta | calcification aneurysm                  | 57.60%         | 75%                  | 0.1446     |
|         |                                          | 0%             | 0%                   |            |
| abdominal aorta | calcification aneurysm                | 77.60%         | 75%                  | 0.6603     |
|         |                                          | 11.80%         | 25%                  | 0.3815     |
| iliac artery | calcification aneurysm                   | 75.30%         | 87.50%               | 0.5287     |
|         |                                          | 47.10%         | 0%                   | 0.7269     |
| peripheral artery | ABI-R ABI-L                           | 1.0 ± 0.2      | 0.9 ± 0.2            | 0.6582     |
|         |                                           | 1.0 ± 0.2      | 0.9 ± 0.2            | 0.6406     |
|         | stenosis                                  | 66.70%         | 37.50%               | 0.3123     |
|         | occlusion                                 | 78.90%         | 37.50%               | 0.3456     |
|         |                                          |                |                      |            |
| IMT: intima media thickness, ABI: ankle brachial index, R: right, L: left

| Table 6 | Breakdown of cases with concomitant abdominal aortic aneurysm |
|---------|----------------------------------------------------------------|
| Case    | Age (y) | CAD status | CL     | AAA status | MD (mm) | 1st TX                     | 2nd TX                     | Interval (day) | Gross result |
|---------|---------|------------|--------|------------|---------|---------------------------|---------------------------|----------------|--------------|
| 1       | 66      | SAP        | 3VD    | non-ruptured | 60      | Pump arrest with IABP     | GR                        | 85             | alive        |
| 2       | 79      | SAP        | 2VD    | ruptured   | 52      | GR                        | OPCAB with IABP           | 55             | alive        |
| 3       | 64      | UAP        | 2VD    | non-ruptured | 55      | OPCAB                     | GR                        | 155            | alive        |
| 4       | 72      | UAP        | LMT+2VD| non-ruptured | 60      | OPCAB with IABP & EVAR   | OPCAB                     | 31             | Late-phase death |
| 5       | 62      | SAP        | 3VD    | ruptured   | 87      | EVAR                      | OPCAB                     | 31             | alive        |
| 6       | 72      | SAP        | 3VD    | non-ruptured | 54      | EVAR                      | OPCAB                     | 20             | alive        |
| 7       | 61      | SAP        | 2VD    | non-ruptured | 64      | OPCAB with IABP           | GR                        | 44             | alive        |

CAD: coronary artery disease, SAP: stable angina pectoris, UAP: unstable angina pectoris, CL: coronary lesion, VD: vessel disease, AAA: abdominal aortic aneurysm, MD: maximum diameter, TX: treatment, IABP: intra-aortic balloon pumping, GR: graft replacement, OPCAB: off-pump coronary artery bypass, EVAR: endovascular aneurysmal repair
tance of perioperative management.  

7. Hemodialysis

In HD patients, the coronary revascularization procedure causes a high rate of major adverse cardiac events (MACE), but freedom from MACE was higher in the CABG group than in the percutaneous coronary intervention (PCI) group. Based on the Japanese database of adult cardiovascular procedures, the results of HD patients undergoing only CABG also showed high rates of operative death and postoperative complications. Concerning long-term late-phase survival rates, 1-year survival was 72.4%, 3-year survival was 48.3%, 5-year survival was 32.4%, and 10-year survival was 14.3%, which were poor, and it was reported that the presence or absence of concomitant PAD had an impact on the long-term prognosis.

For super-elderly and high-risk cases and those with concomitant multiarterial atherosclerotic disease, there are often high expectations of hybrid therapy involving minimal invasion like minimum invasive direct coronary artery bypass and PCI. In case of CABG in the presence of concomitant multiarterial atherosclerotic disease, it is considered possible to maintain good results by performing adequate preoperative systemic tests and taking measures based on the results to prevent complications. However, since there is concern about a decline in the survival rate due to late-phase cardiovascular complications, strict management and early therapeutic intervention are considered important.

VI. Conclusion

Even in the presence of concomitant multiarterial atherosclerotic disease, it is considered possible to obtain good CABG results by being fully aware of the preoperative situation and optimizing the treatment using the currently available surgical procedure, cardiopulmonary bypass, auxiliary circulation, endovascular surgery, perioperative management, etc. Since there is concern about a late-phase decline in survival depending on the atherosclerosis-related factors, strict management and early therapeutic intervention are considered important.

Conflicts of Interest

There are no conflicts of interest to be declared concerning this article.

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