Clinics in Surgery

Case Report
Published: 13 Nov, 2019

Concomitant Brachiocephalic to Bilateral Subclavian Artery Bypass with Off-Pump Coronary Artery Bypass Grafting

Kayo Sugiyama, Hirotaka Watanuki, Masaho Okada, Yasuhiro Futamura, Yukie Ito, Keijiro Hosokawa and Katsuhiko Matsuyama*

Department of Cardiac Surgery, Aichi Medical University Hospital, Japan

Abstract

It is well known that severe coronary artery disease concomitant with severe cerebrovascular disease is associated with poor long-term survival. The appropriate management of this clinical condition remains controversial because of the difficulty in its treatment strategy. Here we report a case of a patient with severe cerebrovascular diseases and acute coronary syndrome who successfully underwent brachiocephalic artery to bilateral subclavian artery bypass concomitantly with off-pump Coronary Artery Bypass Grafting (CABG). Continuous monitoring of cerebral oxygen saturation and pulsatile flow obtained with off-pump CABG effectively protected the brain.

Keywords: Polyvascular disease; Cerebrovascular disease; Coronary artery disease; Off-Pump coronary artery bypass grafting; Interventional radiology

Abbreviations

BCA: Brachiocephalic Artery; SCA: Subclavian Artery; CABG: Coronary Artery Bypass Grafting; **CAD:** Coronary Artery Disease; CVD: Cerebrovascular Disease

OPEN ACCESS

Correspondence:
Kayo Sugiyama, Department of Cardiac Surgery, Aichi Medical University Hospital, 1-1 Yazakokarimata, Nagakute, Aichi 480-1195, Japan, Tel: +81-561-62-3311; Fax: +81-561-63-6193; E-mail: kayotaro3@gmail.com

Received Date: *21 Oct 2019*
Accepted Date: *08 Nov 2019*
Published Date: *13 Nov 2019*

Citation:
Sugiyama K, Watanuki H, Okada M, Futamura Y, Ito Y, Hosokawa K, et al. Concomitant Brachiocephalic to Bilateral Subclavian Artery Bypass with Off-Pump Coronary Artery Bypass Grafting. Clin Surg. 2019; 4: 2655.

Introduction

An atherosclerotic disease is significantly associated with other atherosclerotic diseases [1]. However, the revascularization strategy for multiple vascular diseases remains controversial because of treatment difficulty. There are two choices for treating this condition: staged revascularization and simultaneous revascularization. In staged revascularization, catheter intervention is favorable because of less invasiveness; however, it can be infeasible in anatomically difficult cases. Although it can be highly invasive, simultaneous open surgical revascularization can solve this problem [2,3].

Case Presentation

A 78-year-old man with right-sided lower limb intermittent claudication was referred to our hospital. Computed tomography revealed occlusion of the right common iliac artery (Figure 1A) and dilatation of the right internal mammary artery, which supplied the collateral flow to the right femoral artery (Figure 1A). Abdominal aortography showed a good collateral network to the right femoral artery through the pelvic plexus. Coronary angiography demonstrated severe Coronary Artery Disease (CAD) including severe stenosis of the left main coronary artery (Figure 1B) and total occlusion of the right coronary artery. Further examinations revealed severe Cerebrovascular Disease (CVD) including total occlusion of the right internal carotid artery and left Subclavian Artery (SCA) and severe stenosis of the right SCA and left internal carotid artery (Figure 2A,2B). We recommended to the patient urgent revascularization for these atherosclerotic diseases, but he rejected his treatment and was discharged. One week later, the patient was admitted emergently to our institute with hypoxia caused by the acute coronary syndrome. Considering coexistent comorbidities, emergency open repair for severe CAD and CVD was performed. Following a median sternotomy, the right internal mammary artery was harvested and a segment of the saphenous vein was harvested using a skip skin incision. Because preoperative abdominal angiography showed a good collateral network in the pelvic plexus, we judged that the right internal mammary artery can be used as a Coronary Artery Bypass Grafting (CABG) graft. The left internal mammary artery was not available as a CABG graft because it became atrophic due to occlusion of the left SCA. Following systemic heparinization, an 8-mm expanded polytetrafluoroethylene graft (FUSION;

Figure 1A: Preoperative computed tomography scan showing occlusion of the right common iliac artery (black arrowhead) and dilatation of the right internal mammary artery, which supplied the collateral flow to the right femoral artery (white arrowhead).

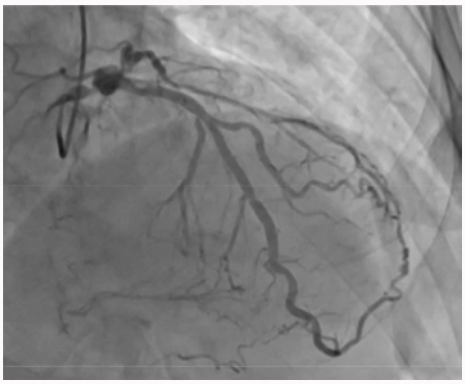

Figure 1B: Preoperative left coronary angiography showing severe stenosis of the left main coronary artery.

MAQUET Co LTD, GENTINGE, Germany) was anastomosed from the Brachiocephalic Artery (BCA) to the bilateral SCA to gain sufficient SCA flow. Off-pump CABG was then performed using the right internal mammary artery to the left anterior descending artery and saphenous vein grafts to the posterior lateral branch and distal site of the right coronary artery. During the procedures, mean blood pressure was maintained above 60 mmHg with continuous monitoring of cerebral oxygen saturation. The patient tolerated the procedure well and had an uncomplicated postoperative course with no neurological deficits. Computed tomography demonstrated the patency of all coronary bypass grafts and the BCA to bilateral SCA bypass graft (Figure 3). Postoperative brain imaging showed no cerebral ischemic changes. After a 2-year follow-up period, he remains stable without any major adverse cardiovascular events.

Discussion

The existence of CVD is significantly associated with mortality and morbidity in patients with CAD [1,4]. The ideal revascularization strategy for severe multiple atherosclerotic diseases remains unconfirmed. There are mainly two strategies: staged revascularization and simultaneous revascularization. Simultaneous

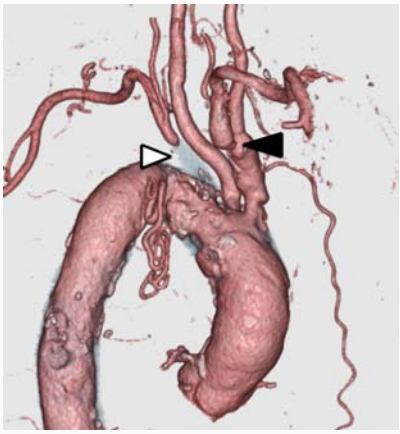

Figure 2A: Preoperative computed tomography scan showing occlusion of the left subclavian artery (white arrowhead) and severe stenosis of the right subclavian artery (black arrowhead).

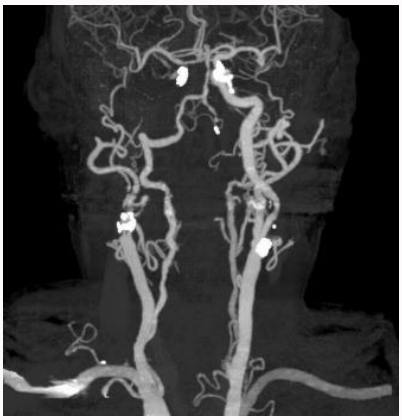

Figure 2B: Preoperative computed tomography scan showing occlusion of the right internal carotid artery and severe stenosis of the left internal carotid artery.

revascularization enables us to treat multiple atherosclerotic diseases concomitantly. Furthermore, a median sternotomy enables achievement of the flow from the ascending aorta or BCA in patients with proximal CVD. The staged procedure can be performed less invasively compared to simultaneous procedure. However, it is difficult to decide the priority of each revascularization. Japanese stroke guidelines presented insufficient evidence that strengthens the advantage of preceding cerebrovascular revascularization in cases of severe CAD [5]. Moreover, it remains unknown how the untreated vascular disease will influence the treated disease after the first revascularization. A bleeding complication can also occur because of dual antiplatelet therapy after revascularization. Percutaneous techniques were introduced to treat peripheral artery disease and reduce the morbidity associated with open surgical treatments in a complex and high-risk patient cohort. However, some problems remain with interventional radiologic treatment, including long-term patency, dual antiplatelet therapy, and anatomical difficulties. In the present case, carotid artery stenting was not intended, primarily because of anatomical difficulties. Moreover, surgical direct revascularization for the carotid diseases was considered overly invasive by neurosurgeons. Therefore, the BCA to bilateral SCA bypass concomitant with CABG was chosen. The use of the internal mammary artery conduit has a proven long-term survival benefit. In

Figure 3: Postoperative computed tomography scan showing patency of all coronary bypass grafts and the brachiocephalic artery to bilateral subclavian artery bypass.

the present case, simultaneous revascularization enabled us to use the right internal mammary artery as a CABG graft because of the right SCA revascularization. Otherwise, using the internal mammary artery as a CABG graft can be associated with worsening peripheral artery disease in the lower extremities. In the present case, the right internal mammary artery was considered available as a CABG graft because the pelvic plexus seemed sufficient. However, whether using cardiopulmonary bypass during concomitant revascularization may increase the risk of poor outcomes is controversial. Takach et al. [2] used cardiopulmonary bypass during CABG in all patients with CAD and CVD. They reported that the outcome is not influenced by the use of cardiopulmonary bypass [2]. Khalil et al. [3] reported successful simultaneous CABG using a transthoracic approach and an aortosubclavian or aortobrachiocephalic artery bypass. They also reported that cardiopulmonary bypass does not increase the risk of morbidity and mortality. In contrast, Berguer et al. [6] reported high mortality rates in their series of patients who had concomitant BCA reconstruction and on-pump CABG. Puskas et al. [7] reported the advantage of off-pump CABG for patients with severe CVD. In patients with severe atherosclerotic changes in the ascending aorta, off-pump CABG might be favorable. Moreover, off-pump CABG enables patients to maintain significant pulsatile flow during the procedure. Some institutions always administer intraoperative intra-aortic balloon pumping to maintain pulsatile flow during CABG [8]. According to these reports, in simultaneous revascularization, off-pump CABG is preferable.

Conclusion

Simultaneous revascularization is effective in cases of severe CAD and CVD. The use of a median sternotomy enables us to obtain proximal flow for CVD. The BCA to SCA bypass enabled use of the internal mammary artery as a CABG graft. The pulsatile flow during off-pump CABG is preferable for patients with severe CVD.

References

1. Steg PG, Bhatt DL, Wilson PW, D'Agostino R Sr, Ohman EM, Röther J, et al. One-year cardiovascular event rates in outpatients with atherothrombosis. JAMA. 2007;297(11):1197-206.
2. Takach TJ, Reul GJ, Duncan JM, Krajcer Z, Livesay JJ, Gregoric ID, et al. Concomitant brachiocephalic and coronary artery disease: Outcome and decision analysis. Ann Thorac Surg. 2005;80:564-9.
3. Khalil A, Nashef SAM. An alternative surgical approach to subclavian and innominate stenosis: a case series. J Cardiothorac Surg. 2010;5:73.
4. Yamazaki T, Goto S, Shigematsu H, Shimada K, Uchiyama S, Nagai R, et al. Prevalence, Awareness and Treatment of Cardiovascular Risk Factors in Patients at High Risk of Atherothrombosis in Japan. Circ J. 2007;71:995-1003.
5. The Japan stroke society.
6. Berguer R, Morasch MD, Kline RA, Kazmers A, Friedland MS. Cervical reconstruction of the supra-aortic trunks. A 16-year experience. J Vasc Surg. 1999;29:239-48.
7. Puskas JD, Thourani VH, Kilgo P, Cooper W, Vassiliades T, Vega JD, et al. Off-pump coronary artery bypass disproportionately benefits high-risk patients. Ann Thorac Surg. 2009;88:1142-7.
8. Fukuda I, Osaka M, Nakata H, Sakamoto H. Clinical outcome for coronary artery bypass grafting in patients with severe carotid occlusive disease. J Cardiol. 2001;38:303-9.