

CASE REPORT

Nagoya J. Med. Sci. 77. 521 ~ 524, 2015

Bilateral internal thoracic artery grafting during David procedure complicated with coronary insufficiency

Suguru Ohira, MD; Kiyoshi Doi, MD, PhD and Hitoshi Yaku, MD, PhD

Department of Cardiovascular Surgery, Kyoto Prefectural University of Medicine, Kyoto, Japan

ABSTRACT

A 47-year-old woman diagnosed with Marfan syndrome underwent valve-sparing aortic root replacement for aortic regurgitation and annulo-aortic ectasia. Her cardiac function was normal. Preoperative coronary angiography did not demonstrate any stenosis. The David reimplantation procedure with a 28-mm Valsalva graft was performed. Both coronary orifices were reconstructed in a button fashion with Teflon felt reinforcement. After aortic declamping, marked bleeding was noted from the left coronary button, requiring a second pump run. Graft interposition using the great saphenous vein was performed for left coronary artery reconstruction. The reconstructed right coronary button was also damaged due to the fragile tissue, and interposed by the vein graft in the same fashion. After the aorta was declamped, the global left ventricular wall motion was significantly impaired, and did not improve with time. Coronary insufficiency was considered. Beating-heart coronary artery bypass grafting with the in-situ bilateral internal thoracic arteries was performed. After revascularization, the left ventricular function was improved. In certain emergent situations compromised with coronary insufficiency, this procedure could be an option to revascularize the coronary arteries.

Key Words: coronary insufficiency, bilateral internal thoracic artery, David procedure

INTRODUCTION

Valve-sparing aortic root replacement (VSRR) has been performed for more than two decades because of its associated excellent long-term results and non-necessity of oral anticoagulation therapy.^{1,2)} Coronary artery complication is one of the serious postoperative complications after aortic root replacement influencing surgical mortality.³⁻⁶⁾ Here, we describe a bail-out procedure of beating-heart coronary artery bypass grafting (CABG) using the bilateral internal thoracic arteries (ITAs) during VSRR complicated with coronary insufficiencies.

CASE

A 47-year-old woman with a history of Marfan syndrome was referred to our department with severe central aortic regurgitation and annulo-aortic ectasia. Preoperative computed coronary

Received: March 20, 2015; accepted: May 13, 2015

Corresponding author: Suguru Ohira, MD

Department of Cardiovascular Surgery, Kyoto Prefectural University of Medicine, 465 Kajii-cho, Kawaramachi-Hirokoji, Kamigyo-ku, Kyoto 602-8566, Japan

Phone: +81-75-251-5752, Fax: +81-75-257-5910, E-mail: s-ohira@koto.kpu-m.ac.jp

angiography demonstrated normal coronary arteries without stenosis. VSRR with a 28-mm Valsalva graft was performed with the David reimplantation technique. Cardioplegic solution was infused every 30 minutes in a selective or retrograde fashion. Both coronary orifices were reconstructed in a button fashion with Teflon felt reinforcement. Fibrin glue (Beriplast, Centeon, Germany) was applied to each anastomotic site to achieve adequate hemostasis. After declamping, marked bleeding emerged from the left coronary button. Cardiac arrest was induced again, and the anastomotic site of the left coronary artery button was found to be extensively torn due to the fragility of the aortic tissues. Therefore, graft interposition with a 3-cm saphenous vein graft (SVG) was performed for left coronary artery reconstruction. Longitudinal incisions were made to cut back the SVG for both proximal and distal anastomoses and both anastomoses were performed in an end-to-end fashion. The same coronary orifice was used as an inflow of the SVG. In addition, the orifice of the right coronary artery also showed imminent tearing. Graft reconstruction with interposition of a 4-cm SVG was also applied to the right coronary artery in the same way as the left coronary artery reconstruction. After the aorta was declamped, the global left ventricle wall motion was significantly impaired, and it did not improve with time. It was difficult to assess the coronary flow by transesophageal echocardiography. Flow insufficiencies of both reconstructed coronary arteries were suspected. To avoid reclamping and manipulating the proximal aorta, CABG with the in-situ bilateral ITAs was planned under a beating-heart condition. The bilateral ITAs were harvested in a skeletonized fashion with an ultrasonic scalpel. Subsequently, the left anterior descending coronary artery was revascularized with the left ITA, and the proximal right coronary artery was reconstructed with the in-situ right ITA. After completion of the anastomoses, the left ventricular wall motion was improved and the patient could be weaned easily from cardiopulmonary bypass. Her postoperative course was uneventful. Postoperative computed tomography demonstrated the stenosis of the reconstructed left coronary artery at the shaft of the SVG and the right coronary artery at the site of distal anastomosis (Fig.1). It also revealed the patency of both in situ ITAs (Fig.2). After a two-year follow-up, aortic regurgitation was trivial to mild without any clinical symptoms.

DISCUSSION

VSRR is applied for aortic root dilatation, annulo-aortic ectasia, and aortic dissection because of its excellent long-term results.^{1,2)} Coronary complications are serious postoperative problems after aortic root replacement influencing surgical mortality.³⁻⁶⁾ In addition to the Carrel patch technique, both artificial and native grafts could be used to reconstruct proximal coronary arteries in aortic root surgery.^{3,4)} Sako *et al.* reported their excellent 18-year experiences of venous graft bypass to native coronary arteries during root replacement.⁴⁾ In the present case, SVG interpositions were necessary due to bleeding from the coronary button. After the second declamp, the global left ventricular wall motion was impaired. We considered the possibility of air embolism in the coronary arteries, but the cardiac function was not improved. In this case, it was difficult to assess the proximal coronary flow by transesophageal echocardiography. Therefore, the diagnosis of coronary insufficiencies was made by wall motion abnormality and unstable hemodynamics. The present case may suggest controversies in how to perform CABG and which grafts should be used. Firstly, we performed CABG with the heart beating to avoid a third aortic clamping. Next, the bilateral ITAs were used because of the young age of the patient. It took about 30 minutes to harvest both ITAs, which was not a prolonged period of time. Postoperative imaging demonstrated stenosis of both reconstructed coronary arteries at the site of interposition with the SVG, being the cause of the impaired ventricular function. Patients with aortitis or hereditary

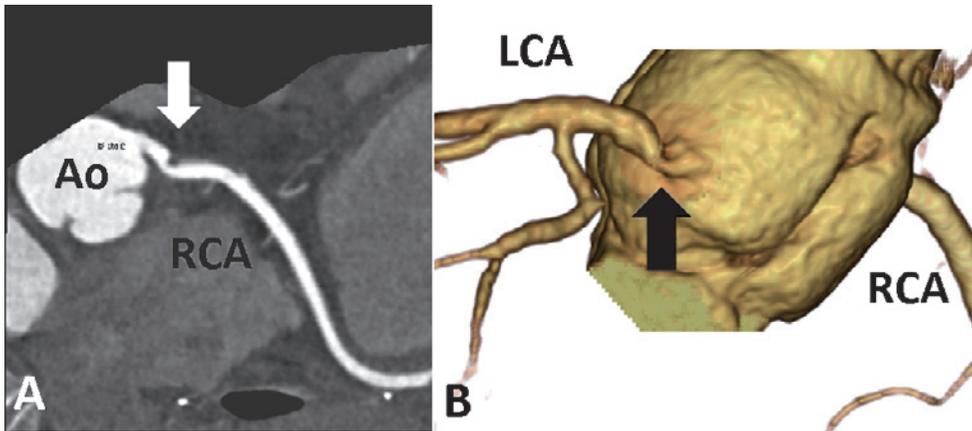


Fig. 1 (A) Postoperative computed tomography demonstrated significant stenosis of the right coronary artery interposed with the saphenous vein graft (arrow). (B) Postoperative 3D computed tomography clearly demonstrated significant stenosis of the left coronary artery interposed with the saphenous vein graft (arrow).
 Ao: aorta
 RCA: right coronary artery
 LCA: left coronary artery

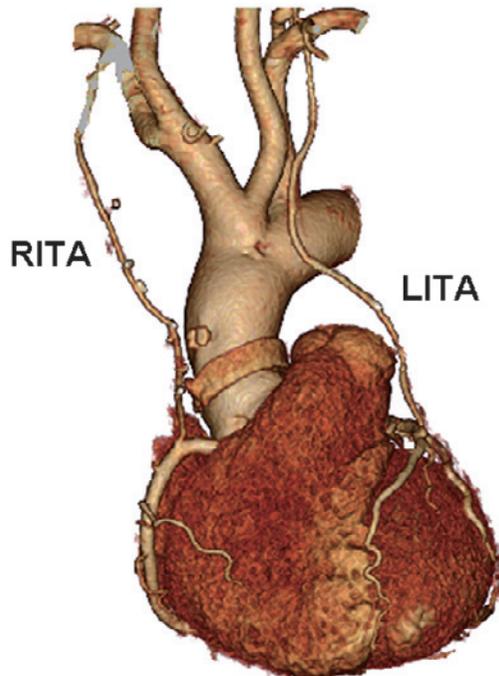


Fig. 2 Postoperative 3D computed tomography demonstrated patent bilateral internal thoracic artery grafting to the left anterior descending artery and proximal right coronary artery, respectively.
 RITA: right internal thoracic artery
 LITA: left internal thoracic artery

connective tissue disorders, including Marfan, Ehler-Danlos, or Loeys-Dietz syndrome, show a high risk of developing suture-related complications.^{7,8)} Involvements of the ITAs and coronary arteries in patients with Marfan syndrome are rare, but they have been reported.^{9,10)} Shahiari *et al.* reported their experiences of coronary complications during aortic root replacement. The rate of rescue coronary artery bypass was 2.2%, and the grafts used involved the SVG and the left ITA.⁶⁾ In such emergent situations, the SVG is used as a bypass graft because it is easy to harvest and handle. Therefore, an alternative bailout procedure in the present case would be aortocoronary bypass using SVG with or without cardiac arrest. Careful follow-up of the coronary arteries, bypass grafts, systemic arteries, and native aortic valves is essential, although the postoperative course of the present case has remained uneventful over the two-year follow-up.

In conclusion, we encountered a case of coronary insufficiency during VSRR and performed beating-heart CABG with in-situ bilateral ITAs as a bail-out procedure. In certain emergent situations compromised with coronary insufficiency, this procedure may be an option to revascularize the coronary arteries.

Conflict of interest: Non declared

REFERENCES

- 1) David TE, Feindel CM, David CM, Manlihot C. A quarter of a century of experience with aortic valve-sparing operations. *J Thorac Cardiovasc Surg*, 2014 Sep; 148(3): 872–9; discussion 879–880.
- 2) Okita Y. Surgery for thoracic aortic disease in Japan: evolving strategies toward the growing enemies. *Gen Thorac Cardiovasc Surg*, 2015 Apr; 63(4): 185–196.
- 3) Maureira P, Vanhuysse F, Martin C, Lekehal M, Carreaux JP, Tran N, Villemot JP. Modified Bentall procedure using two short grafts for coronary reimplantation: long-term results. *Ann Thorac Surg*, 2012 Feb; 93(2): 443–449.
- 4) Sako H, Hadama T, Shigemitsu O, Miyamoto S, Anai H, Wada T. Patency of saphenous vein coronary artery bypass grafts from the vascular prosthesis of the ascending aorta. *Ann Thorac Cardiovasc Surg*, 2003 Jun; 9(3): 170–173.
- 5) Kincaid EH, Cordell AR, Hammon JW, Adair SM, Kon ND. Coronary insufficiency after stentless aortic root replacement: risk factors and solutions. *Ann Thorac Surg*, 2007 Mar; 83(3): 964–968.
- 6) Shahriari A, Eng M, Tranquilli M, Elefteriades JA. Rescue coronary artery bypass grafting (CABG) after aortic composite graft replacement. *J Card Surg*, 2009 Jul–Aug; 24(4): 392–396.
- 7) Matsuura K, Ogino H, Kobayashi J, Ishibashi-Ueda H, Matsuda H, Minatoya K, Sasaki Hiroaki, Bando K, Niwaya K, Tagusari O, Nakajima H, Yagihara T, Kitamura S. Surgical treatment of aortic regurgitation due to Takayasu arteritis: long-term morbidity and mortality. *Circulation*, 2005 Dec 13; 112(24): 3707–3712.
- 8) Tochii M, Hattori K, Ishikawa H, Ishida M, Higuchi Y, Amano K, Sakurai Y, Noda M, Watanabe T, Takagi Y. Mid-term outcomes of cardiovascular surgery for patients with Marfan syndrome. *Gen Thorac Cardiovasc Surg*, 2015 May; 63(5): 267–272.
- 9) Rose JF, Lucas LC, Bui TD, Mills JL Sr. Endovascular treatment of ruptured axillary and large internal mammary artery aneurysms in a patient with Marfan syndrome. *J Vasc Surg*, 2011 Feb; 53(2): 478–482.
- 10) Common AA, Pressacco J, Wilson JK. Internal mammary artery aneurysm in Marfan syndrome: case report. *Can Assoc Radiol J*, 1999 Feb; 50(1): 47–50.