Case Report

A Case of Simultaneous Endovascular Aneurysmal Repair (EVAR) and Coronary Artery Bypass Grafting (CABG)

Shun-ichi Kawarai, MD,1 Gen-ya Yaginuma, MD,2 and Kazuo Abe, MD2

A male patient with abdominal aortic aneurysm (AAA) and coronary artery disease was referred to our hospital. Coronary angiography showed multiple coronary lesions including the left main trunk. Computed tomography revealed a large AAA measuring 78 mm. To prevent aneurysmal rupture after coronary artery bypass grafting or cardiac complications after AAA repair, we performed simultaneous endovascular aneurysmal repair and coronary artery bypass grafting. The postoperative course was uneventful. Endovascular therapy and beating coronary artery bypass grafting is less invasive and may offer another promising option for the treatment of complicated case of AAA with severe coronary artery disease.

Keywords: endovascular aneurysmal repair (evar), coronary artery bypass grafting (CABG), abdominal aortic aneurysm (AAA), coronary artery disease (CAD)

INTRODUCTION

Patients presenting with abdominal aortic aneurysm (AAA) have concomitant coronary artery disease (CAD) in high frequency. The ideal treatment of patients with critical CAD and large or symptomatic AAA remains controversial, particularly with regard to the timing of surgery of each staged or concomitant procedure. Recently, endovascular aneurysmal repair (EVAR) for AAA instead of standard open surgery has expanded rapidly because of its being less invasive. Here, we describe our recent treatment of a case with large AAA and severe CAD concomitantly.

CASE REPORT

A 63-year-old man felt lower abdominal discomfort recently and visited a nearby hospital. He was diagnosed with AAA and referred to our hospital for treatment. On physical examination, a large pulsatile mass was palpable on the umbilical portion. Computed tomography (CT) revealed a large infrarenal fusiform AAA measuring 78 mm in maximal diameter (Fig. 1). Laboratory data were almost normal. He had previous percutaneous coronary intervention (PCI) to the right coronary artery (RCA) 10 years ago because of myocardial infarction, and coronary angiography (CAG) showed moderate stenosis (50%) of the left main trunk (LMT) and severe stenosis (75%–90%) in the origin of the left anterior descending (LAD) artery and the left circumflex (LCX) artery, and RCA was totally occluded at the mid portion (Fig. 2). Left ventriculography showed normal left ventricular function.

Besides these multiple, severe coronary artery lesions including LMT, AAA is a large one. These coronary artery lesions are critical and not suitable for PCI; surgical treatment is mandatory. Although several surgical options can be issued, open AAA repair without prior coronary revascularization can be catastrophic, but there was a possibility of AAA rupture in the waiting interval after CABG. Concomitant open AAA repair and conventional on pump arrest CABG is technically challenging and can be highly invasive. To reduce surgical invasiveness and prevent perioperative complications, we decided to perform a concomitant less invasive operation: EVAR and beating CABG.

1Department of Cardiovascular Surgery, Hachinohe City Hospital, Hachinohe, Aomori, Japan
2Department of Cardiovascular Surgery, Division of Heart and Vascular Institute, Sendai Kosei Hospital, Sendai, Miyagi, Japan

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Corresponding author: Shun-ichi Kawarai, MD. Department of Cardiovascular Surgery, Hachinohe City Hospital, 1, Bishamontai, Tamukai, Hachinohe, Aomori 031-8555, Japan
Tel: +81-178-72-5111, Fax: +81-178-72-5115
E-mail: shun_z_kawa@hospital.hachinohe.aomori.jp
Under general anesthesia, with pharmacological support (continuous intravenous infusion of nicorandil and isosorbite mononitrate), EVAR was initiated. Using Zenith AAA endovascular graft (Cook Medical, Bloomington, IN, USA), EVAR was completed without any hemodynamic compromise. After endovascular treatment, beating CABG under full mediasternotomy was performed in succession with the support of cardiopulmonary bypass composed of closed circuit and centrifugal pump, a so-called “mini-pump.” Harvesting bilateral internal thoracic artery (ITA) and left radial artery (RA) as grafts, complete arterial coronary revascularization was fulfilled (left ITA-LCX, right ITA-LAD, AO-RA-RCA). Postoperative hemodynamics was stable, and he was extubated on postoperative day 1. The postoperative course was uneventful, and he was discharged on postoperative day 14. Postoperative CT images showed good patency of all coronary artery grafts and confirmed no type I, III, or IV endoleak of AAA endovascular graft (Fig. 3).

**DISCUSSION**

It is well known that patients with AAA have concomitant CAD in high frequency. Hertzer et al. reported more...
than 30% incidence of severe correctable CAD in elective AAA patients. In a recent series, it was shown that patients who underwent AAA repair had significant CAD in 27%–47% on CAG in Japan. The leading cause of perioperative mortality in AAA repair is cardiac related, and reduction of cardiac mortality has been an important goal to improve surgical results of AAA repair, especially for patients with a previous history of myocardial infarction or ischemic changes on ECG.

According to the severity of coronary lesions, either PCI or CABG was selected. Two therapeutic strategies regarding the timing and method of CABG in patients with AAA may exist; one is staged operation, and the other is simultaneous operation for CABG and AAA repair. In staged operation, open AAA repair after CABG is the gold standard. Paty et al. reviewed their 1105 consecutive AAA repair cases according to the timing of CABG and AAA repair. In their study, there was no operative death after staged operation within two weeks, but 7 patients had AAA rupture after CABG when they were sent home for some reason. The mean duration between CABG and AAA rupture was $17 \pm 1.8$ days with a median of 19 days. They concluded that staged elective AAA repair after CABG should be performed within two weeks without delay cannot be scheduled for all cases, especially in aged, complicated cases. The other option is simultaneous operation: concomitant AAA repair and CABG. Wolff et al. reported their experience of 13 cases of concomitant procedures with large or symptomatic AAA and severe CAD. In their experience, the overall 30-day mortality and major morbidity was 15% and 31%, respectively. All death was related to massive bleeding because of usage of CPB and prolonged CPB time. Other series showed almost the same results, and they concluded that concomitant operations of conventional on-pump arrest CABG and AAA repair with CPB usage should be limited to cases that are considered to have high AAA rupture risk.

The ideal treatment of patients with large or symptomatic AAA and critical CAD remains controversial, particularly with regard to the timing of surgery of each staged or concomitant surgery. Off-pump CABG (OPCAB) has gained a great majority in Japan and was performed on more than 10352 cases, constituting more than 60% of the total isolated CABG procedures in 2009. It was assumed that OPCAB was relatively less invasive than conventional on-pump arrest CABG; Morimoto et al. have insisted on the usefulness of simultaneous OPCAB and AAA repair in patients needing AAA repair with CAD. A single-staged operation eliminates the risk of
AAA rupture during the interval period while providing definitive surgical treatment that needs only one period of convalescence. However, this strategy is associated with attendant technical challenges.9)

Recently, EVAR for AAA, instead of standard open surgery, has expanded rapidly because of its being less invasive. Particularly, patients at high risk for open abdominal repair have more benefit than low-risk patients.10)

One new, alternative option involves the combination of EVAR and CABG when anatomically appropriate, combined or staged.

Considering EVAR being less invasive, we think that the hemodynamic change during the EVAR procedure is not so appreciable, and there, almost all the patients can tolerate the procedure. Even patients with coronary disease can have an uneventful intraoperative course, as long as pharmacological management is optimized. If CABG were to be performed prior to EVAR, bleeding or oozing from the surgical site might have occurred under a heparinized state during the EVAR procedure. The coronary lesions in our case are multiple and severe, including the LMT lesion; there is the possibility of hemodynamic compromise during anastomosis to LCX or RCA induced by heart positioning. There is also the concern that an insertion of IABP might induce a possible graft migration. That is definitely the reason why we had employed on-pump beating CABG with perfusion support with a mini-pump. In our experience, the insertion of IABP during or after on-pump beating CABG has been rarely required.

Considering the surgical invasiveness, the combination of OPCAB and EVAR may be the most promising treatment. However, optimal treatment must be individualized, staged, or concomitant CABG, and AAA repair may be variable when minimally invasive interventions are not feasible. The optimal interval between AAA repair and CABG should be within two weeks, for a reduction in the risk of rupture for large or symptomatic AAA.11,12)

CONCLUSION

Simultaneous EVAR and CABG are less invasive, as compared with the conventional surgical method. This treatment can be a new strategy of treatment for large or symptomatic abdominal aortic aneurysm with severe coronary artery disease if anatomically appropriate.

Disclosure Statement: We do not have any conflict of interest.

REFERENCES

1) Hertzer NR, Beven EG, Young JR, et al. Coronary artery disease in peripheral vascular patients. A classification of 1000 coronary angiograms and results of surgical management. Ann Surg 1984; 199: 223-33.
2) Sasaki Y, Isobe F, Kinugasa S, et al. Influence of coronary artery disease on operative mortality and long-term survival after abdominal aortic aneurysm repair. Surg Today 2004; 34: 313-7.
3) Takahashi J, Okude J, Gohda T, et al. Coronary artery bypass surgery in patients with abdominal aortic aneurysm: detection and treatment of concomitant coronary artery disease. Ann Thorac Cardiovasc Surg 2002; 8: 213-9.
4) Lachapelle K, Graham AM, Symes JF. Does the clinical evaluation of the cardiac status predict outcome in patients with abdominal aortic aneurysms? J Vasc Surg 1992; 15: 964-70, discussion 970-1.
5) Paty PS, Darling RC, Chang BB, et al. Repair of large abdominal aortic aneurysm should be performed early after coronary artery bypass surgery. J Vasc Surg 2000; 31: 253-9.
6) Kordowicz A, Ghosh J, Baguneid M. A single centre experience of simultaneous open abdominal aortic aneurysm and cardiac surgery. Interact Cardiovasc Thorac Surg 2010; 10: 63-6.
7) Wolff T, Baykut D, Zerkowski HR, et al. Combined abdominal aortic aneurysm repair and coronary artery bypass: presentation of 13 cases and review of the literature. Ann Vasc Surg 2006; 20: 23-9.
8) Sakata R, Fujii Y, et al. Thoracic and cardiovascular surgery in Japan during 2009: annual report by the Japanese Association for Thoracic Surgery. Gen Thorac Cardiovasc Surg 2011; 59: 636-67.
9) Morimoto K, Taniguchi I, Miyasaka S, et al. Combined coronary artery bypass grafting on the beating heart and abdominal aortic aneurysm repair. Circ J 2002; 66: 755-7.
10) Handa N, Tomita S, Kato M, et al. Endovascular stent-graft repair for abdominal aortic aneurysm in a patient with cardiac and renal dysfunction. Gen Thorac Cardiovasc Surg 2009; 57: 203-7.
11) Onwudike M, Barnard M, Singh-Ranger R, et al. For debate: concomitant critical coronary arterial disease and abdominal aortic aneurysm—timings of corrective procedures. Cardiovasc Surg 2000; 8: 333-9.
12) Ruddy JM, Yarbrough W, Brothers T, et al. Abdominal aortic aneurysm and significant coronary artery disease: strategies and options. South Med J 2008; 101: 1113-6.