

A Pulsatile Chest Mass After Bentall Procedure: A Case Report

Xiaofan Huang*, Dashuai Wang*, Yu Songa, Long Wua

Department of Cardiovascular Surgery, Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China

ABSTRACT

Aortic dissection is an aggressive and life-threatening cardiac disease that's highly challenging in surgical operation. Bentall procedure comes with potential complications. How to manage these complications is important when it comes to improving patient outcome. In this case, we present a 41-year-old male patient with iatrogenic aortic dissection. He had aortic valve replacement and repair of an atrial septal defect in 2012. After five years, he suffered reoperation for aortic dissection. A year later, the patient was readmitted for a voluminous pulsatile mass over the anterior thorax, confirming the presence of a huge pseudoaneurysm originating from the left coronary bottom performed during the Bentall procedure. This required a third operation to repair the hemorrhagic site. Pseudoaneurysm is a common complication after inclusion technique in Bentall procedure. Effective hemostasis or tension-free anastomosis is important toward improving patient outcome.

INTRODUCTION

Aortic dissection is an aggressive and life-threatening cardiac disease with high morbidity and mortality [Erbel 2014; Gudbjartsson 2020]. Risk factors for development of aortic dissection mainly include conditions associated with aortic media abnormalities and increased aortic wall stress, such as hypertension and trauma [Bossone 2018]. In addition, the incidence of iatrogenic aortic dissection may increase with the growing number of invasive vascular and cardiac procedures [Nunez-Gil 2015]. Currently, the Bentall procedure in acute aortic dissection therapy is a standard technique, but it remains highly challenging in emergency operation [Erbel 2014; Sabe 2020].

CASE REPORT

Here, we present a 41-year-old male patient with iatrogenic aortic dissection. He had years of history with grade 3 hypertension. The initial cardiac surgery he underwent was

aortic valve replacement and repair of atrial septal defect in Guizhou province in 2012. Follow-up computed tomography angiography in April 2014 indicated aneurysmal dilatation of the aortic root and aortic sinus. In 2015, he was diagnosed with chronic DeBakey type-I aortic dissection in Beijing, and he was treated only with medical treatment.

The man was admitted to Wuhan Union Hospital through the emergency department on 31 December 2017, with a chief complaint of chest tightness and shortness of breath for one week. He suffered from persistent cough, dyspnea, orthopnea, and bilateral lower limb edema after admission. Aortic computed tomography angiography indicated the



Figure 1. The patient presented with progressive chest pain and a pulsatile anterior chest mass.

Received June 9, 2021; accepted June 22, 2021.

* Xiaofan Huang and Dashuai Wang contributed equally to this work.

Correspondence: Long Wu, MD, PhD, Union Hospital, Wuban Jiefang Road, No. 1277, Wuban 430022, China; 15827197218 (e-mail: wulong@bust.edu.cn).

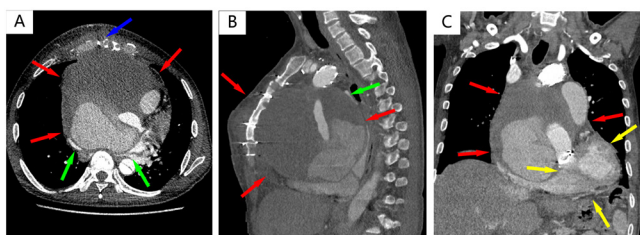


Figure 2. Chest CT scan with contrast-enhancement revealed that the ascending aorta was surrounded by a large saccular mass of mixed densities (14.2cm × 12.8cm × 12.9cm) (Panels A, B and C, red arrow), which was eroding sternum (Panel A, blue arrow). The tumor mass compressed the trachea, pulmonary artery (Panel A and B, green arrow), pushing the heart downwardly toward the left diaphragm (Panel C, yellow arrow).

formation of the DeBakey type-I aortic dissection and the ascending aortic aneurysm, with a maximum diameter of 12.1 * 12.6 cm. Contrast medium was leaked from the aortic to pulmonary arteries. Emergency surgery was performed with right heart failure rapidly exacerbated. The formation of the aortic-pulmonary artery fistula and the ascending aortic dissection, involving the right coronary ostium, were observed during operation. A series of complicated procedures were performed, including removal of the aortic valve prosthesis used in previous surgery, repair of the aortic-pulmonary artery fistula with bovine pericardial patch, composite root replacement using a NO.21 ATS composite valve-graft prosthesis, an end-to-side anastomosis between the left coronary ostium and the aortic graft, insertion of a stented elephant trunk into the descending aorta, and reconstruction of the aortic arch, wrapping around the graft using the native aneurysmal aortic wall and shunting the aneurysm sac to the right atrium. The entire operation lasted 11 hours. The patient recovered well after the operation and was discharged 14 days later.

The patient was readmitted to Wuhan Union Hospital through the emergency department on 28 October 2018, with a chief complaint of progressive chest pain and a pulsatile anterior chest mass for one week (Figure 1). Aortic computed tomography angiography revealed that the ascending aorta was surrounded by a large saccular mass of mixed densities, which eroded sternum. The saccular mass compressed trachea and pulmonary artery, pushing the heart down toward the left diaphragm (Figure 2). Emergency surgery again was performed for the patient. As the character of the mass remained unclear, femoral cannulation was performed, and the temperature was cooled down to 22°C. The mass was found to be thrombus after the skin was cut open and a mass of thrombus was removed from the pericardial cavity. Active bleeding at the left coronary anastomosis also was observed. An 8 mm vascular prosthesis was anastomosed between the left coronary ostium and ascending aorta prosthesis. Then the aortic clamp was released, and an off-pump right coronary artery bypass grafting was performed using the saphenous vein. The duration of the entire surgical procedure was 10.5 hours. The patient was reexamined with aortic computed tomography angiography

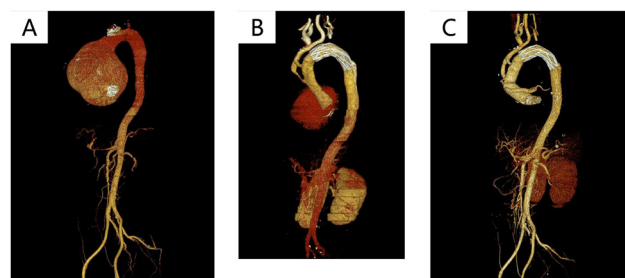


Figure 3. Contrast-enhanced CT 3D reconstruction indicate the aortic dissection before second operation (Panel A), pseudoaneurysm at aortic root before third operation (Panel B) and healed before discharged (Panel C).

showing no abnormalities and was discharged 11 days after the operation (Figure 3).

DISCUSSION

We report a DeBakey type-I aortic dissection after aortic valve replacement occurring in a 41-year-old male patient. The second and third operations were extremely difficult as both were very complicated, and the patient's conditions were severe. Although the patient eventually recovered well, several issues deserve further discussion.

Aortic valve replacement remains the primary surgical treatment for aortic valve disease, however, it has been reported to be one of the independent predictors for the development of type-I aortic dissection [Pham 2012]. Aortic wall fragility, aortic wall thinning, and aortic regurgitation were identified as independent risk factors of late dissection after aortic valve replacement in multivariate analysis, with associated probabilities of 22%, 7%, and 14%, respectively [von Kodolitsch 2000]. Therefore, replacing both the aortic valve and ascending aorta may be a good prophylactic strategy for patients with more than one risk factor [von Kodolitsch 2000]. In addition, it is worth mentioning that surgical techniques appear to be not associated with postoperative dissection as the prevalence of dissection after aortic valve replacement was constant over the years, despite significant advances in surgical strategies [von Kodolitsch 2000].

The composite valve-graft technique has been an important surgical strategy for aortic valve and root pathology since the original description by Hugh Bentall and De Bono in 1968, despite countless modifications. An inclusion technique was used as a generally accepted standard with the intrinsic aorta enclosing the graft for hemostatic purposes. An iatrogenic fistula from the periprosthetic space draining to the right atrium was introduced by Cabrol to decompress the false lumen [Cabrol 1981]. However, detachment or loosening of the anastomosis between the coronary ostium and aortic graft can promote the formation of a pseudoaneurysm, a well-known complication of the Bentall procedure [Niederhauser 1998; Panos 2001].

In this case, the continued expansion of the aneurysm sac penetrated the sternum, compressed the mediastinum and

pulmonary artery, causing a series of symptoms, and thus a third surgery was required. The formation of the huge pseudoaneurysm was associated with the active bleeding of the left coronary anastomosis combined with the closure of the iatrogenic fistula. Effective hemostasis is the key to Bentall procedure; however, it is difficult to directly attach the coronary arteries to the aortic graft [Cabrol 1981]. Several modifications and refinements have been proposed to resolve these issues. Interposition of a segment vascular prosthesis from the aortic graft to the coronary ostia allows for a more tension-free anastomosis [Mills 1996; Piehler 1982; Raanani 2001]. Excision of a small cuff of surrounding aortic tissue as “coronary buttons” can considerably improve the visibility and facilitate the aortic-coronary anastomosis. Nowadays, the “button” modification of the original Bentall procedure has been a standard operative technique and is the one most widely used for aortic root replacement as the safety and long-term efficacy have been confirmed [Karangelis 2018; Westaby 2000].

CONCLUSION

An optimal treatment strategy should be based on a comprehensive assessment of the patient’s condition. For aortic valve disease, whether to perform a single aortic valve replacement or with a simultaneous aortic surgery for a prophylactic purpose should be carefully evaluated. Multiple surgical procedures developed to treat aortic root pathology are now at our disposal, in which the “button” modification of the Bentall procedure is currently most widely used. Nevertheless, no single surgical procedure is perfect. Individualized strategy should be highlighted because the specific anatomy of the patient demonstrated which operation was the most appropriate.

ACKNOWLEDGEMENT

Ethics approval and consent to participate: This study was approved by the Ethical Committee of Tongji Medical College affiliated with Huazhong University of Science and Technology (06/09/2019 S054). The consent of patient was obtained and written informed consent was obtained.

REFERENCES

Bossone E, Labounty TM, Eagle KA. 2018. Acute aortic syndromes:

diagnosis and management, an update. *Eur. Heart J.* 39(9):739-749.

Cabrol C, Pavie A, Gandjbakhch I, et al. 1981. Complete replacement of the ascending aorta with reimplantation of the coronary arteries: new surgical approach. *J Thorac Cardiovasc Surg* 81(2):309-315.

Erbel R, Aboyans V, Boileau C, et al. 2014. 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC). *Eur. Heart J.* 35(41):2873-2926.

Gudbjartsson T, Ahlsson A, Geirsson A, et al. 2020. Acute type A aortic dissection - a review. *Scand. Cardiovasc. J.* 54(1):1-13.

Karangelis D, Tzertzemelis D, Demis AA, et al. 2018. Eighteen years of clinical experience with a modification of the Bentall button technique for total root replacement. *J Thorac Dis* 10(12):6733-6741.

Mills NL, Morgenstern DA, Gaudiani VA, et al. 1996. "Legs" technique for management of widely separated coronary arteries during ascending aortic repair. *Ann. Thorac. Surg.* 61(3):869-874.

Niederhauser U, Rudiger H, Vogt P, et al. 1998. Composite graft replacement of the aortic root in acute dissection. *Eur J Cardiothorac Surg* 13(2):144-150.

Nunez-Gil IJ, Bautista D, Cerrato E, et al. 2015. Incidence, Management, and Immediate- and Long-Term Outcomes After Iatrogenic Aortic Dissection During Diagnostic or Interventional Coronary Procedures. *Circulation* 131(24):2114-2119.

Panos A, Amahzoune B, Robin J, et al. 2001. Influence of technique of coronary artery implantation on long-term results in composite aortic root replacement. *Ann. Thorac. Surg.* 72(5):1497-1501.

Pham N, Zaitoun H, Mohammed TL, et al. 2012. Complications of aortic valve surgery: manifestations at CT and MR imaging. *Radiographics* 32(7):1873-1892.

Piehler JM, Pluth JR. 1982. Replacement of the ascending aorta and aortic valve with a composite graft in patients with nondisplaced coronary ostia. *Ann. Thorac. Surg.* 33(4):406-409.

Raanani E, David TE, Dellgren G, et al. 2001. Redo aortic root replacement: experience with 31 patients. *Ann. Thorac. Surg.* 71(5):1460-1463.

Sabe AA, Percy E, Kaneko T, et al. 2020. When to Consider Deferral of Surgery in Acute Type A Aortic Dissection: A Review. *Ann. Thorac. Surg.*

von Kodolitsch Y, Loose R, Ostermeyer J, et al. 2000. Proximal aortic dissection late after aortic valve surgery: 119 cases of a distinct clinical entity. *The Thoracic and cardiovascular surgeon* 48(6):342.

Westaby S, Katsumata T, Vaccari G. 2000. Aortic root replacement with coronary button re-implantation: low risk and predictable outcome. *Eur J Cardiothorac Surg* 17(3):259-265.