

Title Page

Title:

Cardiac Arrest due to Tamponade during Endovascular Stent Implantation: a Case Report

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Abstract

Hemorrhagic cardiac tamponade is one of potentially fatal complications of endovascular intervention. Usually it is because of perforation of heart or rupture of aorta. Cases of pericardial effusion without any arterial or heart injury are rare. Case presentation we reported is a clinical case of cardiac arrest due to tamponade in a patient with DeBakey type I aortic dissection (AD) undergoing thoracic aortic stent implantation. In the early phase of the procedure, hemodynamic changes of increased central venous pressure and decreased blood pressure - by tamponade were noticed but unrecognized and lead to cardiac arrest ultimately. During resuscitation, cardiac tamponade was suspected and confirmed by transesophageal echocardiography (TEE). The patient was successfully resuscitated after pericardiocentesis. Conclusion This case of cardiac tamponade emphasizes the importance of vigilant clinical and echo assessments, efficient multidisciplinary teamwork in deal with the rare but severe complication.

Introduction

During last decades, hybrid surgical technique has been widely adopted to deal with aortic dissection and gained excellent outcomes [1,2]. It can be performed simultaneously or with a staged approach according to the anatomical defect. This technique is also associated with complications, such as aortic rupture, perforation, endoleak, paraplegia, stroke and acute aortic dissection [3,4]. Hemorrhagic cardiac tamponade is a rare but potentially fatal complication usually derived from perforation of heart or rupture of aorta. Herein, we report a case of cardiac arrest due to tamponade without any arterial injury in a patient with aortic dissection undergoing second-stage surgery of descending aorta stent implantation.

We have obtained the consent of the patient to public his personal materials online.

Case report

A 63-year-old man presented to the emergency room with a complaint of substernal chest pain for 3 days. He has a history of hypertension not treated more than 10 years. The computed tomography angiography (CTA) findings indicated DeBakey type I aortic dissection extended from the aortic root to the left external iliac artery, and involved the brachiocephalic trunk and left subclavian artery (Figure1). After admission, hemiarch replacement and Bentall operation were performed under cardiopulmonary bypass. Twenty days after that surgery, he was scheduled to the second-stage surgery of aortic stent implantation and supra-aortic debranching.

On presentation, the initially vital signs were stable and general anesthesia was induced successfully. Systemic anticoagulation was achieved with heparin 150 IU/kg and activated clotting time of whole blood (ACT) ranged from 375-999s. Under the guidance of angiography, an aortic stent was implanted retrogradely via femoral artery, starting from the innominate artery till descending aorta. A chimney stent was placed in the innominate artery, and carotid-carotid cross-over bypass was performed. All procedures lasted for 7 hours. His vital signs were stable till anaphylactic shock occurred by administration of protamine. The epinephrine (100ug) was administrated and moderate hyperventilation, the hemodynamic status was stable again except atrial fibrillation. But thereafter we had to infuse norepinephrine continuously to maintain blood pressure and at this time, the central venous pressure (CVP) increased and ranged from 17 to 19 mmHg.

Angiography was performed and the location of stents, flow of branch were satisfied. Just after angiography, the electrocardiography (ECG) and the wave of artery blood pressure suddenly presented straight line and cardiac arrest was confirmed. Chest compressions were commenced immediately and epinephrine 100ug was given intravenously. About 30 seconds later, spontaneous circulation returned with blood pressure (BP): 145-155/85-93mmHg, CVP: 21-35 mmHg and heart rate (HR): 145-150/min with atrial fibrillation. Near infrared reflectance spectroscopy (NIRS) could not be detected on both sides.

Acute cardiac tamponade was suspected and transesophageal echocardiography (TEE) was performed. It showed large pericardial effusion and collapsed right heart chambers especially the right atrium (Figure 2A). Nothing unusual was found in thoracic and abdominal sonography. Thereafter catheter pericardiocentesis was performed immediately. After median incision in the area of the xiphoid and blunt dissection of the pericardium, nearly 300ml bloody fluid were aspirated. Three minutes following that procedure, there was no sign of further bleeding, then pericardial drainage tube was inserted. TEE indicated that the pericardial effusion decreased and the right atrium was refilled (Figure 2B). CVP decreased to 19-24mmHg, BP increased to 101-147/70-74mmHg and atrial fibrillation reversed to sinus rhythm automatically. The patient was transferred to intensive care unit (ICU) and the then CVP decreased to 11-15 mmHg eventually. He discharged without any neurological complications 2 weeks postoperatively.

Discussion

Acute aortic dissection is a life-threatening emergency with high mortality. It was reported that about 21% patients died before admission and over 70% patients involving ascending aorta received emergency surgery [5]. At present, there is debate on the optimal surgical approach for aortic arch dissection. Open surgery repair is regarded as the standard intervention especially in emergency cases. Hybrid approach (staged or simultaneously) might have higher survival and lower complications rate associated with the long duration of cardiopulmonary bypass, hypothermic circulatory arrest and antegrade/retrograde cerebral perfusion [6]. The decision depends on surgical skills and physician preference, the overall quality of the aortic vessels and whether cerebral perfusion can be maintained adequately.

In our case, the cause of cardiac tamponade is unclear. It's not caused by heart injury. Because after pericardial drainage, there were no further bleeding. We supposed that it is presumably caused by multiple factors including anticoagulation treatment, long duration of the procedure and previous cardiac operation. Perhaps, a tiny bleeding location existed since the previous operation weeks earlier. Cardiac tamponade during endovascular interventions is rare but associated with high mortality. It induces diastolic problem, and inotropic agents are generally ineffective. TEE is indicated to aid in the diagnosis and treatment of cardiac tamponade [7]. But TEE was not used from the outset of the operation routinely in hybrid or thoracic endovascular aortic repair (TEVAR) procedure in our hospital. Because the probe which placed in the esophagus or stomach will interfere with fluoroscopic

visualization of vascular structures. For patients with complex thoracic aortic disease history, TEE was only used as rescue or after angiography. Maybe thereafter, we should discuss with surgeon and place TEE from onset of the procedure and withdraw the probe during TEVAR procedure.

Acknowledgments

Not applicable

Conflict of Interest Statement

The authors declare that they have no competing interests.

References

- [1] Antoniou GA, Mireskandari M, Bicknell CD, Cheshire NJ, Gibbs RG, Hamady M, Wolfe JH, Jenkins MP. Hybrid repair of the aortic arch in patients with extensive aortic disease. *Eur J Vasc Endovasc Surg*. 2010; 40:715-21.
- [2] Sun LZ, Qi RD, Zhu JM, Liu YM, Qian C, Zheng J. Repair of acute type A dissection: our experiences and results. *Ann Thorac Surg*. 2011; 91:1147-52.
- [3] Geisbusch P, Kotelis D, Muller-Eschner M, Hyhlik-Durr A, Bockler D. Complications after aortic arch hybrid repair. *J Vasc Surg*. 2011; 53:935-41.
- [4] De Rango P, Cao P, Ferrer C, Simonte G, Coscarella C, Cieri E, Pogany G, Verzini F. Aortic arch debranching and thoracic endovascular repair. *J Vasc Surg*. 2014; 59:107-14.
- [5] Mussa FF, Horton JD, Moridzadeh R, Nicholson J, Trimarchi S, Eagle KA. Acute Aortic Dissection and Intramural Hematoma: A Systematic Review. *JAMA*. 2016; 316(7):754–763.
- [6] Milewski RK, Szeto WY, Pochettino A, Moser GW, Moeller P, Bavaria JE. Have hybrid procedures replaced open aortic arch reconstruction in high-risk patients? A comparative study of elective open arch debranching with endovascular stent graft placement and conventional elective open total and distal aortic arch reconstruction. *J Thorac Cardiovasc Surg* 2010; 140:590-7.
- [7]. Kearns MJ, Walley KR. Tamponade: Hemodynamic and Echocardiographic Diagnosis. *Chest*. 2018; 153(5):1266–75.

Figure Legends

Figure 1: Reconstructed image of computed tomography angiography (CTA). Arrows indicate the dissection of the aortic wall and the false lumen.

Figure 2: Four chamber view on the transesophageal echocardiography. A. A large loculated pericardial effusion and the heart chambers on the right side collapsed, especially the right atrium. B. pericardial effusion decreased and the right atrium was refilled after the drainage.

Figures

Figure 1



Figure 2

