A Practical Tool to Control Bleeding During Sternal Reentry for Pseudoaneurysm of the Ascending Aorta

Anil Z. Apaydin, MD, Hakan Posacioglu, MD, Fatih Islamoglu, MD, and Ali Telli, MD

Department of Cardiovascular Surgery, Ege University Medical School, Izmir, Turkey

Big pseudoaneurysms of the ascending aorta after a previous thoracic operation are rare and represent a surgical challenge. Because the rupture during sternal reentry occurs before the clamp-control of the distal ascending aorta, it is essential to control the bleeding until the adhesions are released in order to place the sternal retractor. We report the use of Foley catheter with a malleable guidewire to control the bleeding from the defect in the ascending aorta causing a pseudoaneurysm in case of a limited access.

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Sternotomy in redo operations for big pseudoaneurysms of the ascending aorta is a surgical challenge, because the rupture is sometimes inevitable. In these circumstances, the use of femorofemoral bypass before sternotomy is a well-known strategy [1]. Because the rupture during sternal reentry occurs before the clamp-control of the distal ascending aorta, it is essential to control the bleeding until the adhesions between the heart and the sternum are released in order to place the sternal retractor. Instituting cardiopulmonary bypass (CPB) in case of a rupture will not control the bleeding, but maintain the partial perfusion only. We have invented a practical tool to be used during sternal reentry to control the bleeding from the defect in the ascending aorta causing a pseudoaneurysm.

Technique

A 57-year-old woman presented with progressive shortness of breath, vague abdominal symptoms, and mental depression 2 months after having an aortic valve replacement for endocarditis in another institution. Computed tomography of the chest was suggestive of a possible pseudoaneurysm of the ascending aorta (Fig 1). An aortogram verified the diagnosis. Because the signs of compression on the right atrium and the right ventricle were noted on the transthoracic echocardiographic study, patient underwent urgent operation.

The right femoral artery and the vein were dissected and cannulated after full heparinization. Then the sternum was exposed. The anterior table of the sternum was divided by using an oscillating saw. The lower half of the posterior table was divided by using a scissors. It was noted that only a very thin, membrane-like tissue constituted the wall of the aneurysm. Despite a meticulous dissection the pseudoaneurysm was entered in the mid portion of the sternum. The CPB was initiated to empty the heart, lower the arterial pressure, and transfuse the shed blood. The remainder of the posterior table of the sternum was quickly divided. The pump was turned off and the patient was exsanguinated to the pump reservoir to be able to localize the source of bleeding through the small gap between the sternal halves. Because trying to place the sternal retractor at this stage could damage the right ventricle because of the dense adhesions we initially tried to control the bleeding by finger compression. The defect was deep in the mediastinum and the first assistant's hand obscured the exposure of the operative field.

To obtain a better exposure and to control the bleeding while releasing the adhesions, we used a simple instrument consisting of a 16F Foley catheter and a guidewire of a left atrial vent (the guidewire introducer of a 16F adult silicone left heart vent, Medtronic DLP cannulas catalog #12016, Medtronic Inc, Minneapolis, MN) (Fig 2A). The guidewire was inserted to the lumen of the Foley catheter at length. Then the balloon of the Foley catheter was inflated with normal saline. The tip of the catheter was inserted into the defect and the balloon was pushed against the aortic wall to control the bleeding (Fig 2B). The blood in the reservoir was transfused back to the patient and the CPB was temporarily terminated.

While this instrument is in place, the mediastinal and pericardial adhesions were freed to allow the placement of the sternal retractor. The ascending aorta was freed from the adjacent structures. The defect causing the pseudoaneurysm had originated from the previous aortotomy suture line, and was 1 cm in diameter. No signs of infection were noted. Specimens were taken from the aneurysm wall and the aorta for microbiologic cultures. Cardiopulmonary bypass was reinstituted and the patient was cooled to a rectal temperature of 28°C. The heart fibrillated spontaneously. Neither cardioplegia nor left ventricular venting was used. Direct closure of the defect seemed appropriate. Pump flow was lowered for a few minutes and the repair was performed by using two interrupted U-mattress 4-0 polypropylene sutures with pledgets. After the heart was defibrillated, the patient was warmed and weaned from the CPB. The patient was

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Address reprint requests to Dr Apaydin, Department of Cardiovascular Surgery, Ege University Medical School, Izmir, Turkey 35100; e-mail: apaydina@efes.net.tr.

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Fig 1. Computed tomographic image of the pseudoaneurysm of the ascending aorta.

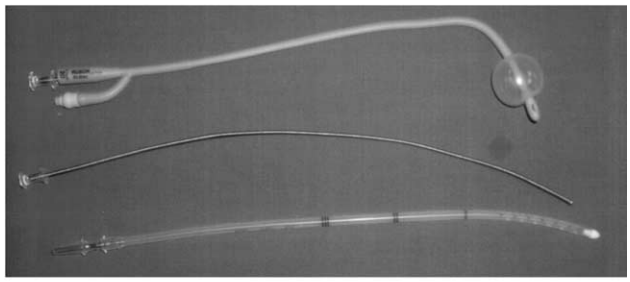
extubated 24 hours after the operation and did not develop any cardiovascular complications. Cultures were negative. Her mental depression became worse after the operation, but responded well to the antidepressants, and she was discharged 1 month after the operation.

Comment

Pseudoaneurysms of the ascending aorta after a previous thoracic operation are rare. When defining the operative strategy, the concerns are the surgical approach, control of bleeding, placement of the aortic cross-clamp, myocardial protection by means of cardioplegia administration or left ventricular venting, and releasing the adhesions. Median sternotomy with the use of femorofemoral bypass and hypothermic circulatory arrest has been the strategy of choice [1]. However, freeing the adhesions for exposure and clamp placement at the expense of brain ischemia, and left ventricular distension before sternal entry are the main drawbacks of this technique. The Port-Access (Heartport Inc, Redwood City, CA) system was used to overcome some of the above-mentioned concerns, since it permitted endoaortic clamping, left ventricular venting and cardioplegia administration before incision and circulatory arrest [2].

There have been several reports regarding the use of Foley catheter in cardiac surgery [3–5]. The use of Foley catheter to control the bleeding during repair of an ascending aortic pseudoaneurysm was reported by Stassano and associates [6]. In all reports, the Foley catheter was inserted through a defect or a laceration and its balloon inflated inside of a lumen and then gentle traction applied to control the bleeding. This maneuver may not be easy to do in the ascending aorta in case of a limited exposure. Furthermore, the ascending aorta has a relatively small lumen and a high velocity blood flow.

We used the Foley catheter with a malleable guidewire for temporary external compression of an aortic bleeding in case of a limited access. The tip of the Foley catheter can be inserted into the defect easily. The guidewire-introducer is malleable but stiff enough to direct the tip of the Foley catheter and to push the balloon against the aortic wall. Once the tip of the catheter is in the aortic defect, the fluid-filled balloon distributes the applied pressure evenly around it. This tool has the potential to be used for temporary control of bleeding due to lacerations of the deep mediastinal structures in cases of limited exposure. Although the situations that may require the use of this tool are rare, we believe that our technique will be of benefit to other cardiovascular surgeons and should be in their armamentarium, because Foley catheters are available in most operating rooms.



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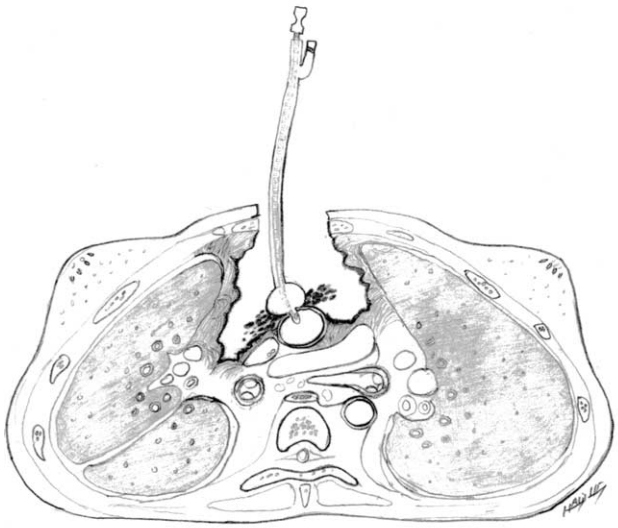

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Fig 2. (A) Foley catheter (top instrument) with a malleable guidewire introducer (middle instrument) of a 16F adult silicone left heart vent (bottom instrument). (B) Control of bleeding from the defect causing the pseudoaneurysm by using the Foley with a malleable guidewire. 20F instruments can also be used.

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