Case Report

An Aortic Root Pseudoaneurysm That Developed after Implantation of a Rectus Abdominis Muscle Flap to Treat an MRSA Mediastinitis: A Case Report

Takeshiro Fujii, MD, Yoshinori Watanabe, MD, Noritsugu Shiono, MD, Tsukasa Ozawa, MD, Satoshi Hamada, MD, Hiroshi Masuhara, MD, Chikao Teramoto, MD, Masanori Hara, MD, Tomonori Katayanagi, MD, Yuki Sasaki, MD, and Nobuya Koyama, MD

The occurrence of mediastinitis following synthetic vascular replacement surgery is still associated with an unfavorable prognosis in the treatment of thoracic aortic diseases. This time we report a Bentall procedure that we reperformed to treat an aortic root pseudoaneurysm, which developed after a postoperative mediastinitis. This followed the first Bentall procedure, which was treated by debridement of the focus of infection, continuous lavage, and a two-step rectus abdominis muscle flap implantation. Implantation of a rectus abdominis muscle flap is effective in controlling infection in the treatment of mediastinitis after heart surgery. However, after synthetic vascular replacement surgeries have been performed to treat aortic diseases, especially after aortic root reconstruction surgery, which puts stress on the anastomotic site, consideration should be given regarding the development of hemorrhages and pseudoaneurysms as a result of infection-induced tissue fragilization. (Ann Thorac Cardiovasc Surg 2010; 16: 63–66)

Key words: aortic root reconstruction, mediastinitis, methicillin-resistant *Staphylococcus aureus*, continuous lavage, rectus abdominis muscle flap implantation

Background

Although mediastinitis after major cardiovascular surgery has been associated with an unfavorable prognosis, it is gradually improving, as shown in the reported treatment results. However, the occurrence of a mediastinitis after synthetic vascular replacement surgery for the treatment of thoracic aortic diseases still has an unfavorable prognosis.[1)] This time we report a Bentall procedure we reperformed to treat an aortic root pseudoaneurysm that developed after a postoperative mediastinitis following the first Bentall procedure was treated by debridement of the focus of infection, continuous lavage, and a two-step rectus abdominis muscle flap implantation.

Case

A 20-year-old male with Marfan syndrome and annuloaortic ectasia (largest diameter: 70 mm) was operated on by Bentall procedure, using a 25 mm Carboseal, after being diagnosed with aortic regurgitation. Preoperative bacteria cultures of the nasal cavity and other sites were not performed. On the 2nd postoperative day, a small amount of purulent fluid was drained from the subxiphoid pericardial drain, and the patient's respiratory status worsened. He had methicillin-resistant *Staphylococcus aureus* (MRSA) sepsis and had to be put on an artificial respirator. Vancomycin began to be administered, but on the 6th postoperative day, mediastinitis was diagnosed when a disruption of the midline

From Division of Cardiovascular Surgery, Department of Surgery, School of Medicine, Faculty of Medicine, Toho University, Tokyo, Japan

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Address reprint requests to Takeshiro Fujii, MD: Division of Cardiovascular Surgery, Department of Surgery, School of Medicine, Faculty of Medicine, Toho University, 6–11–1 Omorinishi, Ota-ku, Tokyo 143–8541, Japan.

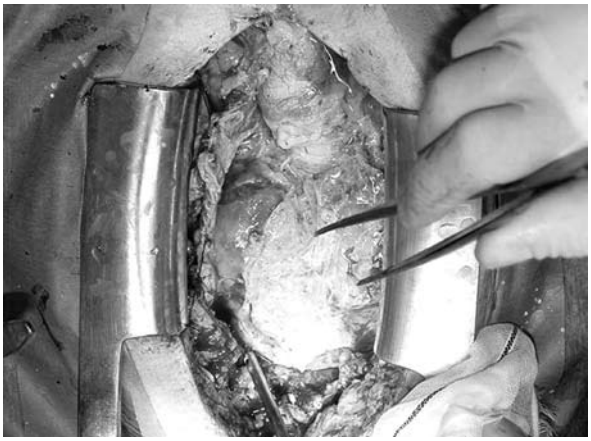

Fig. 1. Mediastinitis caused by MRSA, developing after the Bentall procedure.
Tissue destruction caused by infection was advanced and extensive, but nothing abnormal was found at the anastomotic site of the synthetic vascular prosthesis.

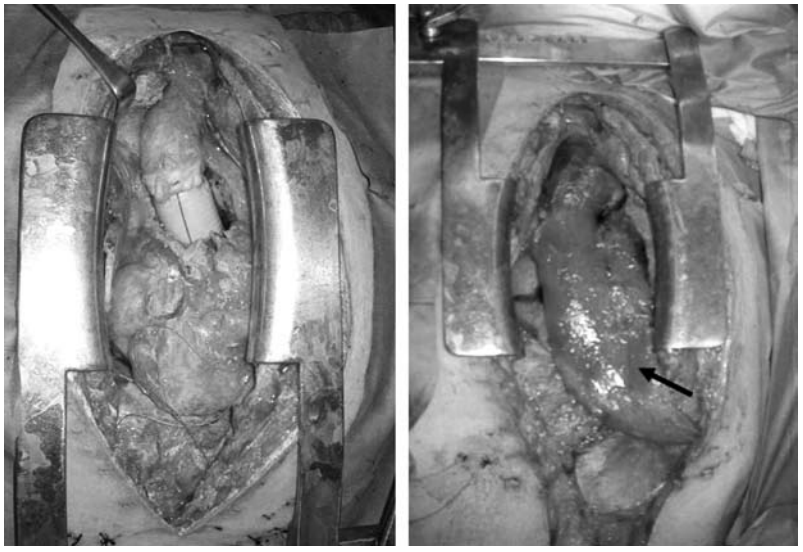

Fig. 2.
A: Continuous lavage.
Since infection inside the mediastinum was under control, since there was no tissue destruction, and since nothing abnormal was found at the peripheral anastomotic site of the synthetic vascular prosthesis, at the aortic root, or at the coronary artery reconstruction site, the vascular graft prosthesis was preserved.
B: Rectus abdominis muscle flap implantation.
The anterior mediastinum was filled, using the rectus abdominis muscle (arrow) on the left.

wound and an increased quantity of the purulent fluid from the drain were found. On the 7th postoperative day, the thorax was reopened. Inside the mediastinum, infection had caused severe tissue breakdown (Fig. 1), and as debridement was performed, a hemorrhage was found on the right side of the main trunk of the pulmonary artery. Hemostasis was difficult to achieve; therefore pericardial patch-grafting was performed with a cardiopulmonary pump, using an equine pericardial patch. After a week-long continuous lavage with normal saline solution (Fig. 2A), a rectus abdominis muscle flap was implanted on the 14th postoperative day after the Bentall procedure (Fig. 2B). Since infection inside the mediastinum was under control, since there was no tissue breakdown, and since no abnormality was found at the peripheral anastomotic site of the synthetic vascular prosthesis, at the aortic root, or at the coronary artery reconstruction site, the vascular graft prosthesis was preserved. Continuous lavage was conducted postoperatively for 14 days, and the patient attended rehabilitation in general wards, but on the 41st postoperative day after the implantation, a chest CT scan was performed because of a sudden chest pain (Fig. 3). An arterial pseudoaneurysm—using the rectus abdominis muscle as the pseudoaneurysm wall—was diagnosed,

and an emergency surgical treatment was performed.

Surgical Procedure

Cardiac arrest was obtained under intermittent anterograde myocardial protection, with a circulatory arrest at a low body temperature (rectal temperature 28°C), a left femoral artery perfusion, and drainage to the right atrium by the left femoral vein approach. Because myotomy was started on the rectus abdominis muscle, which was believed to be the wall of the pseudoaneurysm, a semicircular detachment was found at the front part of the base of the previously grafted Carboseal, and a pseudoaneurysm was diagnosed to originate from the same site. The surrounding tissue showed no findings that may raise suspicion of infection, and there was no alteration resulting from tissue fragilization at the peripheral anastomotic site of the synthetic vascular prosthesis or at the coronary artery reconstruction site. Fragilized tissues at the aortic root were resected, and a Bentall procedure was reperformed using a 25 mm Carboseal. The artificial vascular wall from the previous operation was used for coronary artery reconstruction.

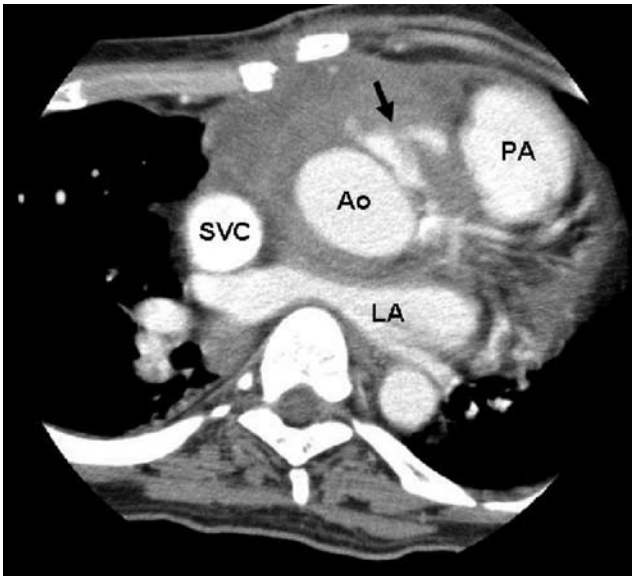

Fig. 3. Thoracic CT on the 41st postoperative day after rectus abdominis muscle flap implantation.
A radiopaque pseudoaneurysm (arrow) was found in the anterior mediastinum between the rectus abdominis muscle and the synthetic vascular prosthesis.
SVC, superior vena cava; Ao, aorta; PA, pulmonary artery; LA, left artrium.

Postoperative Progression

Even though there was a prolonged postoperative inflammatory reaction, there were improvements and a hospital discharge was planned, but the patient died of a sudden ventricular fibrillation and cardiac arrest.

Pathological Autopsy

The mediastinum and the areas surrounding the synthetic vascular prosthesis showed no findings that may raise a suspicion of relapsing infection caused by the mediastinitis. No pseudoaneurysms or hemorrhage was found at the anastomotic site. There was severe irreversible myocardial fibrosis resulting from aortic regurgitation.

Discussion

Although the occurrence of mediastinitis after major cardiovascular surgery has been associated with an unfavorable prognosis, it is improving as shown in the reports on (1) continuous lavage methods, (2) vacuum-assisted closure (VAC),[2] (3) omental implantation, and (4) pedunculated muscular flaps.[3] We, too, have achieved good results in treating postoperative mediastinitis by selecting either one of the pectoralis major muscles, the latissimus dorsi muscle or the rectus abdominis muscle, or several pedunculated muscular flaps for implantation. We have taken into consideration the volume of the anterior mediastinum, the anatomical locations and relations therein, and the muscle masses after debridement of the focus of infection and continuous lavage. Recently, VAC has been actively adopted. Use of the greater omentum is avoided for fear of post-filling atrophy. However, postoperative treatment after synthetic vascular replacement surgery in thoracic aortic diseases is difficult. There is no established treatment yet, and the prognosis is unfavorable. The treatment of infected synthetic vascular prostheses is conducted by (1) extirpation of the infected synthetic vascular prosthesis,[4] (2) grafting of synthetic vascular prostheses containing antibiotics,[5] (3) homograft transplantation,[6] or additionally, by a combination of the aforementioned treatment methods. In a postoperative mediastinitis involving an infected synthetic vascular prosthesis, however, it would be difficult to opt for a treatment by extirpation of the infected synthetic vascular prosthesis or by regrafting, given the patient's poor general condition, blood contamination by bacteria resulting from the use of cardiopulmonary pumps, and the possibility of extension of the surgical method associated with tissue fragilization. By reviewing the progression of

this case, infection was controlled by debridement of the focus of infection, continuous lavage, and pedunculated muscular flaps using the rectus abdominis muscle; there was no problem with the peripheral anastomotic site of the synthetic vascular prosthesis, especially at the aortic root, which was under stress and where a pseudoaneurysm had developed in association with tissue fragilization since the early stages of the infection. Therefore the treatment method we chose this time is also a possible alternative for treating infected intrathoracic synthetic vascular prostheses other than the aortic root if the extirpation of the infected synthetic vascular prosthesis is difficult because of the patient's general condition or the condition of the focus of infection.[3,7] However, when this method is chosen, it is important to control infection at its early stages to prevent tissue fragilization and a weakening of the anastomotic site. Besides debridement of infected tissues, other methods include (1) autologous tissue implantation,[8] (2) continuous lavage after autologous tissue implantation, and (3) autologous tissue implantation after continuous lavage. To select the method, consideration must be given to the infection-causing bacterial strain, the status of the infection, or the surrounding facilities. Moreover, mediastinal volume and anatomic locations and relations in the mediastinum need to be taken into consideration in selecting the tissue for the flap.

Conclusion

Because this case was very likely to be an MRSA carrier, it is considered important to perform nasal cavity culture preoperatively from now on, and in the event of a positive result, plan the surgery after eradication of the concerned bacteria. It is also considered important to remove the infected synthetic blood vessel immediately after improving the infected environment. Then perform resurgery and simultaneous filling with the greater omentum or a muscle, though the surgical procedure may be expanded.

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