Vacuum-assisted Closure System for the Treatment of Mediastinitis after Total Aortic Arch Replacement

A 77-year-old man developed deep sternal wound infection with *Enterobacter cloacae* 4 days after total aortic arch replacement for distal aortic arch aneurysm. Reexploration and open drainage of the mediastinum was carried out for 4 days, and the vacuum-assisted closure system was applied and continued for 10 days. During the treatment, granulation formation and neovascularization was apparently enhanced which lead us to perform omental transfer and chest closure on the 18th postoperative day. The patient has been free from recurrent sign of mediastinal infection or graft infection for the 19 months of the follow-up period. (Jpn J Thorac Cardiovasc Surg 2005; 53: 638–640)

**Key words:** vacuum-assisted closure system, mediastinitis, prosthetic vascular graft, aortic arch aneurysm

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**Postoperative mediastinitis** is a serious complication of cardiac surgery when performed through a median sternotomy. It is potentially lethal when complicated with aortic surgery where generous prosthetic vascular grafts are used. The vacuum-assisted wound closure (VAC) system is a new noninvasive modality of treatment to enhance granulation in nonhealing and infected sternotomies. The system essentially provides negative pressure by controlled suction to the wound surface. We elected to apply this system to a patient with deep sternal wound infection complicating thoracic aortic surgery.

**Case**

A 77-year-old man patient developed DeBakey type IIIb acute aortic dissection in February 2002, and was treated medically in a local hospital. A follow-up computed tomography of the thoracic aorta performed one year later revealed a giant ulcer-like projection on the distal aortic arch. He was referred to our institution for surgical management of the aortic aneurysm.

In February 2003, he underwent replacement of the total aortic arch with a four-branched prosthetic vascular graft under cardiopulmonary bypass with the selective cerebral perfusion technique. On the 4th postoperative day, signs of infection including leukocytosis and increased C-reactive protein of 390 mg/L were noted. The appearance of the midline sternotomy incision was slightly reddish. With these findings, reexploration of the mediastinum was undertaken. There was a retrosternal purulent fluid collection, and the prosthetic vascular graft in the aortic arch was covered with pus. Debridement of the deep sternal wound surface was performed, and copious irrigation was also done. Subsequent open drainage of the mediastinum was carried out.

Microbiological cultures from mediastinal fluid, blood, and sputum, all yielded *Enterobacter cloacae*. Based on these microbiological results, an antibiotic regimen was also intensified appropriately. Dressing changes were carried out twice daily using diluted povidon iodine-soaked towel gauze and wet-to-dry gauze. Open drainage was continued for 4 days. however, there was still grave concern about graft infection because of the large amount of prosthetic vascular grafts that were implanted in the aortic arch. We attempted to apply the VAC system, a promising new modality of therapy for a nonhealing wound, on the 8th postoperative day to
salvage the life-threatening condition. The VAC system consisted of polyurethane foam dressing (Hydrosite, Smith & Nephew Inc., Florida, FL, USA), a noncollapsible chest tube, and a vacuum machine (HAMA Servo drain, Hama Medical Industrial Co. Ltd., Tokyo, Japan) (Figs. 1, 2) to generate continuous negative pressure of 99 mmHg. Before we sheeted pieces of trimmed polyurethane foam dressing, we sliced off the coating surface of the sheet in order to ensure that negative pressure from the other side is well transferred down to the mediastinal tissue. It was felt that fragmented sheets would fit better to the wound surface, obliterating gaps. We changed the VAC system everyday to enable us to observe the condition of the mediastinum, especially the prosthetic grafts, and to perform copious irrigation with 1 liter of warm saline. Repeated cultures were also possible at the time of daily irrigation. Cultures of mediastinal fluid became negative 6 days after introduction of the VAC system. A dry appearance in the deep mediastinum was notable in addition to remarkable granulation and neovascularization on the subcutaneous tissue. On postoperative day 18, omental transposition was undertaken (Fig. 3). The patient was extubated two weeks later uneventfully. A postoperative computed tomography was negative for recurrent mediastinitis. He was transferred back to the referring hospital for rehabilitation. The patient has been free from recurrent sign of mediastinal infection or graft infection for the 19 months of the follow-up period.

Discussion

The incidence of postoperative deep sternal wound infection following cardiac surgery has been variably reported within the literature, as has the most appropriate therapeutic intervention for its resolution. The associated complications of post cardiac surgical mediastinitis have been documented and represent a significant cause of morbidity, and occasionally mortality, within this subset of cardiac surgical patients. Treatment protocols at most centers depend on the severity of infection and may involve surgical debridement, drainage, irrigation, and delayed sternal closure with omentum or a pectoral muscle flap.

The VAC system was originally adopted for the treatment of pressure ulcers and other chronic wounds. The applications for the VAC system steadily increased over time and have been extended to poststernotomy mediastinitis. The system is principally based on a uniform negative pressure by controlled suction to the wound surface. The roles of packed polyurethane foam are threefold. It prevents disruption of suction caused by a stuck chest tube. Secondly, it also protects mediastinal tissue from being injured with localized intense negative pressure. Thirdly, it can help to eliminate any dead space beyond mechanically adhered tissue where negative pressure can no longer reach. In other words, it exerts a role in evenly distributing negative pressure to the entire surface of the mediastinum.

We elected to apply this system to a patient with deep sternal wound infection complicating aortic arch procedure using a branched prosthetic graft. The effectiveness of the VAC system on microcirculation and the promotion of granulation tissue proliferation has been proven. In fact, we noted remarkable granulation on the soft tissues within the mediastinal cavity in our case. During