Case report - Thoracic non-oncologic

Delayed sternal closure after vacuum-assisted closure therapy for tracheo-innominate artery fistula repair

Ryo Suzuki, Akihito Mikamo*, Hiroshi Kurazumi, Kimikazu Hamano

Division of Cardiac Surgery, Department of Surgery and Clinical Science, Yamaguchi University Graduate School of Medicine, 1-1-1 Minami-Kogushi, Ube, Yamaguchi 755-8505, Japan

Received 1 March 2011; received in revised form 7 May 2011; accepted 16 May 2011

Abstract

We report a case of successful innominate artery resection with delayed sternal closure after vacuum-assisted closure (VAC) therapy for a tracheo-innominate artery fistula (TIF). A 42-year-old woman with cerebral palsy underwent tracheostomy for respiratory assistance. On postoperative day 14, she was transferred to our hospital after an episode of massive hemoptysis. TIF was diagnosed based on the findings of multidetector computed tomography. Thus, we resected the innominate artery and started VAC therapy to control the postoperative local infection. The patient recovered uneventfully, without any infectious sequelae. Our strategy, which includes VAC therapy, for TIF repair may eliminate postoperative infective problems that could induce sequential bleeding and sternal compromise. To our knowledge, this is the first report of using VAC therapy for TIF.

Keywords: Tracheo-innominate artery fistula; Tracheostomy; Vacuum-assisted closure therapy

1. Introduction

Tracheo-innominate artery fistula (TIF) is a serious complication after tracheostomy. Although many procedures for this potentially fatal complication have been reported, preventing postoperative local infection, which induces recurrent bleeding and sternal compromise, is imperative. We report a case of successful delayed sternal closure following vacuum-assisted closure (VAC) therapy for TIF.

2. Case report

The patient was a 42-year-old woman with cerebral palsy, who had empyema caused by Pseudomonas aeruginosa after aspiration pneumonia. After treatment with antibiotics, she underwent tracheostomy for respiratory assistance. On postoperative day 14, she suffered massive hemoptysis resulting in shock, and was transferred to our hospital. After the hemorrhage had been controlled by balloon over-inflation of the tracheostomy tube-cuff, she became hemodynamically stable. A multidetector computed tomography scan revealed that the tracheostomy had penetrated the innominate artery (Fig. 1). A cerebral angiogram was carried out to assess the intracranial circulation. A balloon hemostatic device was introduced at the innominate artery to control bleeding, and the angiogram revealed good intracranial circulation despite the antegrade blood flow being interrupted by the hemostatic device. The patient was then transferred to the operating room.

After the balloon hemostatic device had been inflated, the tracheostomy tube was removed and an orotracheal tube was introduced. Thereafter, we operated through the median sternotomy. The innominate artery proximal to the fistula and right common carotid and subclavian arteries were mobilized, taking care to preserve the junction between the right subclavian and common carotid arteries. After removing the hemostatic device, we clamped the innominate artery, which was dissected, revealing the fistula. The innominate artery was resected away from the fistula, and the divided ends were oversewn. The tracheal defect found around the fifth tracheal ring was too large to close directly. A residual tracheal defect communicated with the anterior mediastinum. The thymus and sternohyoid muscles were placed over the tracheal defect to separate it from the anterior mediastinum. Finally, polyurethane foam sponge was cut and fitted into the anterior mediastinum, and negative pressure was initiated for VAC therapy. Replacement and irrigation was done every few days, followed by vacuum-assisted wound management. The VAC therapy was protected by adherent dressing tape on the anterior mediastinum and polyurethane foam, maintaining a negative pressure of approximately 100 mmHg. The patient had been on respiratory support via an orotracheal tube, and would need airway management in the future.

On postoperative 14, after confirming healing of the previous tracheal defect distal to the normal tracheostomy...
Gelman et al. reported in their review that only 15.8% of maintenance flow patients and 71.2% of interruption of flow patients survived for longer than two months after a TIF repair [6]. Most of the deaths of the maintenance flow patients were attributed to failure of a direct suture repair and graft replacement, with recurrent bleeding. Consequently, most authors did not recommend direct suture repair of the infected artery or prosthesis placement in the infected field, but advocated resection or ligation of the innominate artery [6, 7].

However, any procedure would have a high incidence of local or mediastinal infection, because the artery, fistula and operative field have been already infected or contaminated [7]. Even if an infected innominate artery is resected, the operative field is still contaminated after the defect or fistula of the trachea has been explored. Mediastinal infection was encountered in 8% of patients who survived an operation for a TIF, performed through a median sternotomy, which is the most common approach for repair [1]. Because mediastinal infection is a life-threatening complication, we decided to resect the infected artery, and applied the VAC technique to manage the infected operative field where the tracheal defect had been explored. In fact, Pseudomonas aeruginosa, revealed preoperatively by sputum culture, was identified in the mediastinal tissue and polyurethane sponge culture after resection of an infected segment of the innominate artery. VAC therapy was reported for the treatment of a wide spectrum of wounds, and its use has extended to mediastinal infection [8]. The principle of this device, which fixes negative pressure applied to the wound, is based on the removal of exudate, improvement of the microcirculation, enhancement of tissue granulation and bacterial clearance. The management of TIF with VAC therapy has not been reported before, probably because the operative field is not obviously infected. However, in this case, Pseudomonas aeruginosa was identified by mediastinal tissue culture postoperatively. VAC therapy would be a reasonable treatment for TIF that predisposes the operative field to contamination.

We evaluated our patient’s intracranial circulation preoperatively so that her neurological function was not exacerbated after interruption of innominate arterial flow. Although it has been reported that an interruption of innominate arterial flow is neurologically safe in young people [6], some authors recommend preoperative evaluation of cerebral circulation whenever possible, considering that resection of the innominate artery carries a significant risk of neurological sequelae in elderly patients [9]. We performed a preoperative angiogram, introducing an intraluminal hemostatic device to control sudden bleeding. We strongly recommend angiographic assessment of the cerebral circulation to permit interruption of innominate arterial flow for patients whose condition can be temporarily stabilized in one way or another [10]. If vascular continity and antegrade flow are necessary for maintaining cerebral circulation, or there is no time to assess the intracranial circulation due to uncontrollable bleeding preoperatively, reconstruction with clean inflow and outflow (such as an axillo-axillary arterial bypass using a polyester graft) should be done simultaneously in elderly patients.

Fig. 1. Multidetector computed tomography scan revealing a tracheo-innominate artery fistula. The arrow indicates penetration of the trachea into the innominate artery.

Fig. 2. Bronchoscopy revealed granulation tissue formation at the thoracotomy defect on the tenth postoperative day. White arrows indicate the defect of tracheostomy which had existed before.
4. Conclusion

VAC therapy augmented by resection of an infected artery was effective and could become the treatment of choice to prevent postoperative infection and recurrent bleeding in the management of TIF.

References


