» **Case Report** «

Emergent Rescue Operation for Expanding Mycotic Pseudoaneurysm Causing Hemoptysis, Originating from Right Subclavian Artery

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Mycotic pseudoaneurysm of the subclavian artery is uncommon and its therapeutic strategy has not been established. We report a case of 81-year-old woman with mycotic pseudoaneurysm in the right subclavian artery. Blood culture showed *Enterobacter cloacae*. Because of hemoptysis and acute expansion of the pseudoaneurysm, emergent coil embolization was performed, but failed. The patient underwent urgent operation for an en-bloc resection of the pseudoaneurysm after aorto-right common carotid artery bypass followed by omentum packing. The patient underwent continuous wound irrigation for 3 weeks. The postoperative course was uneventful and without recurrence of infection.

Key word: mycotic pseudoaneurysm, subclavian artery, saphenous vein graft

Introduction

Aneurysm originating from the subclavian artery has been infrequently reported, but usually requires quick decisions on therapeutic strategy. When associated with local infection, this condition usually leads to development of pseudoaneurysm, which can cause peripheral ischemia or rupture. We report a case of expanding mycotic (*Enterobacter cloacae*) pseudoaneurysm at the origin of the right subclavian artery, in which en-bloc

resection and revascularization of the carotid artery were successfully performed subsequent to failed endovascular treatment.

Case Report

An 81-year-old diabetic woman was admitted to a neighboring hospital, complaining of high fever (38–40°C), nausea, appetite loss, and lumbago. White blood cell (WBC) count was 13500/mm³ and C-reactive protein (CRP) was 19.1 mg/dl. Because pyrogenic spondylitis at Th11/12 was highly suspected on lumbar x-ray, she was transferred to the Department of Orthopedic surgery. On the day following her admission, she had high fever (39°C) with WBC and CRP of 29400/mm³ and 20.36 mg/dl. A chest x-ray film demonstrated a well-defined, non-calcified soft tissue opacity projecting from the right superior mediastinal border. Computed tomography (CT) demonstrated a pseudoaneurysm, 30 mm × 40 mm in diameter, which was initially thought to have originated from the right innominate artery and was surrounded by fluid with entrapped air (Fig. 1). A nodular mass was incidentally found in the right thyroid gland. She was given the meropenem (1 g/day) and vancomycin (1 g/day) based on a diagnosis of infectious pseudoaneurysm. Blood culture showed *Enterobacter cloacae*. One week later, although the values of WBC (19600/mm³) and CRP (7.75 mg/dl) were reduced, the pseudoaneurysm was expanded on the chest x-ray, and was associated with sudden onset of hemoptysis. The CT showed that the pseudoaneurysm had increased in size to 60 mm × 70 mm (Fig. 2a) and was found to have originated from the right subclavian artery in the three dimensional image. The ostium of the pseudoaneurysm was very close to the right common carotid arterial bifurcation (Fig. 2b). Emergent coil embolization was performed, but failed because of the wide ostium of the pseudoaneurysm. Despite the continued presence of an infectious condition, the patient underwent an urgent operation to avoid sudden rupture and death. The right femoral artery and vein were exposed in advance, in preparation for rapid establishment of cardiopulmonary

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Fig. 1 Chest CT at admission. On the chest CT, the pseudoaneurysm (30 mm × 40 mm), appeared to have originated from the right innominate artery, and to have massive gas production and a surrounding irregular fibrous wall. CT: computed tomography.

Fig. 2 Chest CT immediately before operation. There was a remarkable increase in the size of the pseudoaneurysm (60 mm × 70 mm) and the projection area of the blood within the pseudoaneurysm (a). Three-dimensional CT showed that the pseudoaneurysm developed from the origin of the right subclavian artery (b). CT: computed tomography.

bypass (CPB). The right common carotid artery (RCCA) was exposed and a great saphenous vein graft (SVG) was harvested. Median sternotomy was performed uneventfully. After systemic heparinization, the SVG was grafted to the RCCA using continuous 5-0 polypropylene suture in side to end fashion. A shunt tube measuring 3.0 mm diameter was inserted during anastomosis. The clamp time of RCCA

was two minutes. A partial clamp was placed on the ascending aorta and the proximal end of the SVG was grafted to the aorta. The brachiocephalic artery (BCA) and RCCA proximal to SVG anastomosis were clamped, and an incision was made on the pseudoaneurysm. Retrograde flow from the stump of the RSA was controlled by inserting and inflating a Forley catheter. There were fresh thrombus in the pseudoaneurysm surrounded by thickening soft tissue. Nerves around the pseudoaneurysm were not clearly identified. To prevent infection-induced dehiscence, the stumps of the RSA and BCA were wrapped with autologous pericardium and closed using continuous 4-0 Polypropylene sutures. The RCCA was closed directly because of its considerable distance from the pseudoaneurysm. A right subtotal thyroidectomy was performed for the mass lesion. The omentum was transferred and packed around the pseudoaneurysm and each vascular stump. Two tubes were placed near the site of the resected pseudoaneurysm, one for irrigation and the other for drainage. For nutritional support, a jejunostomy tube was inserted. The postoperative course was uneventful and without neurologic complications. Postoperative antibiotic therapy using intravenous meropenem was continued for 3 weeks. Closed irrigation with drainage by 1000 ml/day of normal saline was maintained for 3 weeks until repeated bacterial culture of the drainage fluid proved negative. After 3 weeks, antibacterial agent was changed from intravenous to oral. Postoperative CT showed the SVG graft was patent (Fig. 3). The histopathological findings of aneurysmal sac revealed necrotic changes with active inflammation, and bacterial culture of hematoma within the pseudoaneurysm showed *Enterobacter cloacae*. The patient became afebrile at the 5th postoperative day (POD) and was discharged home with normalized values of WBC and CRP, 5 weeks later. She had had no recurrence of infection at 7 years after the operation.

Discussion

The selection of therapeutic strategy for mycotic pseudoaneurysm of the subclavian artery depends not only on systemic conditions, which include body temperature and parameters of infection (such as WBC count and CRP), but also on local condition—including change in size of the pseudoaneurysm and presence of hemoptysis due to its direct invasion of the trachea. Most surgeons are reluctant to undertake emergent operation for patients with active systemic active bacterial infection, but prefer to perform elective operation once systemic infection has become well controlled by potent antibiotic therapy. However, in cases of rapidly expanding pseudoaneurysm or hemoptysis, emergent treatment should be performed to avoid sudden death as was done in our case. This therapy includes

Fig. 3 Post operative three-dimensional CT. The pseudoaneurysm was completely resected with the surrounding right innominate artery and the origin of the right subclavian artery. The SVG from the ascending aorta to the RCCA was patent. CT: computed tomography; SVG: saphenous vein graft; RCCA: right common carotid artery.

endovascular treatment and open surgery. In most cases, endovascular treatment may be considered initially because it is a much less invasive procedure for such patients, who have poor general condition due to bacteremia. Krohg-Sørensen and coworkers reported three high-risk cases of mycotic aneurysm who were treated by stent-grafting, two successfully.¹⁾ Another successful case of stent-grafting was reported by Sanada and colleagues.²⁾ Among several other cases of mycotic aneurysm treated by stent-grafting in the literature, Pruitt and Malek reported cases of infectious pseudoaneurysm originating from stent-graft infection.^{3,4)} Performance of stent-grafting under an active infectious status remains controversial. Nevertheless, we believe that stent-grafting should be attempted in the first instance—as an emergent, life-saving procedure. However, for cases in which endovascular treatment has failed, patients are required to undergo urgent operation. Whatever the infectious condition, one must not hesitate to perform emergent operation in cases that feature acute expansion of the pseudoaneurysm or hemoptysis, which have the potential to cause sudden death from rupture or massive hemoptysis.⁵⁾ The selection of operative approach may be determined mainly from the location of the pseudoaneurysm.⁶⁾ A thoracotomy approach is to be selected when the pseudoan-

eurysm originates somewhat distally to the origin of the subclavian artery and where its proximal ligation is easily performed. However, in cases wherein the pseudoaneurysm is located at the origin of the subclavian artery and reconstruction of the carotid artery perfusion is required, median sternotomy is to be selected. One of the most devastating problems during the operation is sudden rupture of the pseudoaneurysm, which requires quick establishment of CPB. Therefore, exposure of the femoral artery and vein prior to sternotomy is essential. We have chosen to perform grafting from the ascending aorta to the distal common carotid artery using the SVG, in advance. The establishment of cerebral circulation avoided the use of CPB with deep hypothermic circulatory arrest (DHCA)—even at sudden rupture—which we believe prevents exacerbation of systemic infection that is otherwise amplified by the use of CPB. Although radical resection of pseudoaneurysm with its surrounding tissue is essential, supplemental procedures are required to prevent early recurrence of local infection. Reinforcement at the transected arterial stumps by autologous pericardium (to prevent pseudoaneurysm formation from arterial stumps) and packing at the upper mediastinum by omentum were expected to work against early recurrence of local infection.⁷⁾ Prevention of late recurrence of infection is another important issue. Upon recurrence of infection, a far more complicated operation would be required, using DHCA because of dense infectious adhesion around the previous pseudoaneurysm. A long period of local irrigation and antibiotic treatment even after bacterial culture proves negative and thought essential to prevent local late recurrence. In this case, the patient with trivial atherosclerosis had no other aneurysms. Although the cause of *Enterobacter cloacae* septicemia was unclear in this case, we speculate the etiology of the mycotic pseudoaneurysm was infection rather than degeneration. The accumulation of experience will yield therapeutic guidelines for perioperative management of this devastating disorder.

Disclosure Statement

All authors declare that they have no conflict of interest.

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