**Case
Report**

Profuse Mediastinal Hemorrhage due to Mediastinitis after a Sternal Infection

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A 79-year-old female patient was admitted because of profuse bleeding from a skin defect in the anterior chest due to a deep sternal wound infection. Eighteen years earlier, she had undergone irradiation to treat a sternal metastasis from breast cancer. Computed tomography (CT) showed the extravasation of iodinated contrast material from the ascending aorta. The patient underwent an immediate thoracotomy and recovered. This report presents a very rare case of massive bleeding from the thoracic aorta due to a mediastinal infection after irradiation for sternal metastasis from breast cancer.

Keywords: ascending aorta, bleeding, mediastinal infection, sternal wound infection

Introduction

Aortic hemorrhage is relatively less common in cases of sternal infection. In addition, mediastinitis is a serious complication after median sternotomy,¹⁾ but has rarely been described to induce a fatal spontaneous hemorrhage. We describe a very rare case of aortic hemorrhage due to mediastinal infection after irradiation for sternal bone metastasis.

Case Report

A 79-year-old female patient was admitted because of

profuse bleeding from a deep sternal wound infection. The patient had undergone a radical mastectomy for right-sided breast cancer 34 years earlier. Eighteen years earlier, a solitary bone metastasis had been detected in the sternum, and radiation therapy was performed. Nine months earlier, the skin of the anterior chest underwent necrotic changes. A physician diagnosed sternal osteomyelitis with methicillin-resistant *Staphylococcus aureus* infection based on bacterial cultures. Despite intravenous bacteriostatic agents, including vancomycin, the signs of infection continued, and the condition of the anterior chest skin deteriorated. A physician irrigated the sternum and anterior mediastinum through the skin defect with normal saline. Eight months after the signs of infection were first seen, hemorrhage occurred from the skin defect in the anterior chest through the mediastinum. Consequently, the patient was transferred to our hospital emergency room.

Computed tomography (CT) showed the extravasation of iodinated contrast material between the infected sternum and ascending aorta. Three-dimensional CT (using a 64-row multislice Aquilion™ 64, Toshiba Medical Systems, Tokyo, Japan) showed an irregular shape in the arterial wall (**Fig. 1**). We suspected bleeding from the internal mammary artery and performed emergency surgery to remove the necrotic skin, infectious/fragile

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Fig. 1 Three-dimensional computed tomography (3D-CT) images. (A) Anterior and (B) left anterolateral views. Arrowheads show the extravasation of iodinated contrast material from the ascending aorta.

sternum, and clotted blood. Then, there was a sudden eruption of the blood from the anterior aspect of the ascending aorta, which proved to be due to a perforation a few millimeters in diameter. We put a purse-string suture around the perforation and were able to control the bleeding. The defect in the sternum remained and the anterior mediastinum was left open. Subsequently, open mediastinal irrigation was performed.

On hospital-day 8, the patient was weaned from ventilator support. On day 9, she was transferred from the intensive care unit to a general ward. On day 30, she collapsed and hemorrhaged from the mediastinum. Emergency surgery revealed a rupture of the aortic wall at a different site from the initial hemorrhage. We inserted a purse-string suture at the perforated site using a patch; resuscitation was successful. The mediastinal irrigation was restarted and continued.

On day 42, we performed mediastinal debridement and reconstructed the anterior chest wall with a pedicled major pectoral muscle flap with a skin pedicle. The debrided mediastinal structures were covered with the muscle graft. On day 44, she was transferred from the intensive care unit to a general ward. The subsequent postoperative course was uneventful, and the patient was transferred to her previous hospital on day 53.

Discussion and Conclusion

The English literature includes a report of a deep sternal wound infection that caused right ventricle rupture, which is a potentially fatal complication that occurs

in 5%–21% of conventionally treated deep sternal wound infections.^{2–5)} However, no case similar to ours was found in the English literature in a PubMed search (available at <http://www.ncbi.nlm.nih.gov/pubmed/>), using “rupture” and “hemorrhage” connected with “mediastinitis” as index words. This is the first report of an ascending aorta hemorrhage due to recurrent mediastinal infection after irradiation for sternal bone metastasis from breast cancer.

El Oakley, et al.¹⁾ proposed the following classification of mediastinitis after a median sternotomy. Type I mediastinitis presents within 2 weeks postoperatively, while type II presents in 2–6 weeks. When types I and II have one or more associated risk factors, they are upgraded to types IIIA and IIIB, respectively. If one therapeutic trial fails, then failed types I–III become type IVA. If more than one therapy fails, the mediastinitis is classified as type IVB. Mediastinitis occurring more than 6 weeks postoperatively is type V. Our patient did not undergo a median sternotomy, but we feel that our case could be categorized as type V.

There is a possibility that the radiation caused not only the skin necrosis and infection that extended to the mediastinum but also the aortic rupture. Poon, et al.⁶⁾ postulated that infection combined with radiation damage may trigger the breakdown of tissues. They presented both microscopic and ultrastructural changes in a human aorta that ruptured 5 months after radiation therapy for esophageal cancer. Their autopsy findings showed that the ruptured portion of the aorta revealed sharply demarcated necrosis of the entire wall. The elastic fibers in this region showed complete breakdown

without any cellular reaction. Electron microscopy showed that the radiated aorta exhibited preservation of collagen fibers and smooth muscle, but slit-like spaces in individual elastic laminae were noted. There was irregular fragmentation of the elastic fibers with nonreactive radiation necrosis at the site of rupture. Himmel, et al.⁷⁾ reviewed radiation-induced chronic arterial injury. They noted patterns of injury to human vessels exposed to therapeutic doses of radiation,⁸⁾ such as subendothelial connective tissue proliferation, disruption of the elastic lamina, accumulation of intimal and subintimal fibrinoid substances, degeneration of smooth muscle, dense fibrosis of the adventitia, aggregates of foamy histiocytes in the damaged wall, and eventual obliteration of the vasa vasorum.^{7,9)}

Gram-positive bacteria are the organisms isolated most commonly in mediastinitis; *S. aureus* or *S. epidermidis* is identified in 70%–80% of cases.^{10,11)} Mixed infections can account for up to 40% of cases.¹²⁾ Gram-negative organisms and fungal infections are infrequently incriminated as the main cause of mediastinitis.¹³⁾

The treatment of mediastinitis varies from simple prolonged antibiotic therapy¹⁴⁾ to a complete sternectomy combined with a major plastic procedure.^{15–17)} Similarly, wound incision and drainage alone carries a mortality rate of 23% and a failure rate of 39%.¹⁴⁾ Therefore, prolonged antibiotic therapy alone for mediastinitis is not acceptable. If antibiotic therapy, drainage, or irrigation is abandoned, we must decide the surgical treatment as a matter of course.

The Lund University Hospital mediastinitis algorithm is a systematic approach for treatment decisions to handle postoperative mediastinitis. Secondary wound closure is recommended after systemic antibiotic treatment for 4–6 weeks, if the C-reactive protein levels are below 7 mg/dl.¹⁸⁾ Ultimately, we believe that the timing of chest closure depends on the surgeon's experience and evaluation of the local status.

Disclosure Statement

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