Case Report

Sterilization using Antibiotic-impregnated Porous Hydroxyapatite Block for Osteomyelitis of Rib and Sternum : A Case Report

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A 79-year-old woman was referred to our department with osteomyelitis of the first rib and sternum. She had previously undergone left radical mastectomy for breast cancer and partial resection of the left clavicle. Pus had been observed on the medial side of the residual clavicle. After debridement, an antibiotic-loaded porous hydroxyapatite block was placed to sterilize the wound. Although the wound was dehiscent, no positive results were obtained for bacterial culture. Because the patient's ipsilateral pectoralis major muscle had been removed during radical mastectomy, the wound was closed using sternocleidomastoid muscle and skin flaps. No evidence of wound dehiscence was apparent after 5 years. Antibiotic impregnated block placement may prove useful when local sterilization is required.

Key Words : hydroxyapatite block, osteomyelitis

Introduction

Curing osteomyelitis is difficult unless effective concentrations of suitable antibiotics can be locally maintained to control infection. Herein we describe a technique for the sterilization of osteomyelitis in the rib and sternum using an antibiotic-impregnated hydroxyapatite block, which has been used in orthopedic surgery, to maintain high concentrations of antibiotic.

Case Report

A 79-year-old female underwent left radical mastectomy for breast cancer 11 years earlier. Four years ago, she underwent partial resection of the left clavicle and left upper lobe of the lung for

suspected bone and lung metastases from breast cancer. Postoperative pathological diagnoses for the clavicle and left upper lobe of the lung were osteohyperplasia and organizing pneumonia, respectively.

At 5 months after the last operation, pus was observed on the medial side of the clavicle (**Fig. 1A**). Therapy involving drainage and local antibiotic application had been performed for 4 years in a local hospital. The patient was then referred for further treatment.

Fistulography demonstrated a limited cavity (**Fig. 1B**). Computed tomography (CT) showed partial destruction of the first rib and sternum, indicating osteomyelitis. The fistula displayed no connection with the intrathoracic cavity (**Fig. 1C**). Results of serum chemistry and complete blood count were within normal limits. *Staphylococcus aureus* (2+amount), that was not methicillin-resistant *Staphylococcus aureus* (MRSA), sensitive to

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Fig.1 A) Preoperative findings showing fistula with pus discharge from the anterior chest. B) Fistulography demonstrating a limited cavity (arrow) in the left upper lesion. C) CT fistulography showing no significant progression of fistula into the intrathoracic lesion.

Fig.2 Hydroxyapatite block (total 2.5 cm³ containing arbekacin sulfate (ABK) 100 mg/cm³) was placed into the sternum and defect space of the first rib-sternal joint after debridement.

arbakacin sulfate (ABK) was only cultured from the pus. Debridement of the destroyed rib and sternum was performed. Antibiotic-impregnated porous hydroxyapatite blocks were placed to sterilize the wound (total volume, 2.5 cm³; containing ABK 100 mg/cm³) (Fig. 2).

The block (composition, Ca₁₀ (PO₄)₆ (OH)₂; porosity, 50%; pore size, 2-2000 μm) (Asahi Opti-

Fig.3 A) The Mixevac II High-Vacuum Mixing System (Stryker, USA). B) A convenient mixing system using a syringe. C) Hydroxyapatite block composition, Ca₁₀ (PO₄)₆ (OH)₂; porosity, 50%; pore size, 2-2000 μm; and immersion in antibiotic solution.

cal, Tokyo, Japan) was immersed in an antibiotic solution and vacuumed under 127-254 mmHg for 20 min using a vacuum Mixevac II High-Vacuum Mixing System (Stryker, Kalamazoo, MI, USA) (Fig. 3).

The patient was administered intravenously with 1g of flomoxef sodium, that was also sensitive to *Staphylococcus aureus*, every day for 5 days. On postoperative day 11, the wound was seen to be dehiscant. However, no positive bacterial cultures were obtained. Local application of prostaglandin E1 ointment to enhance the development of granulation was unsuccessful. The wound remained dehiscant until postoperative day 77, with no positive bacterial culture. As the pectoralis major muscle had been removed during radical mastectomy, we therefore closed the wound with sternocleidomastoid muscle and skin flaps. No evidence of wound dehiscence was apparent after 5 years.

Discussion

Curing infection of the chest wall after thoracotomy is difficult. We performed debridement of the infected bones using antibiotic-impregnated blocks rather than en-bloc resection to minimize defects of the chest wall. Although primary closure failed, the wound was made aseptic.

Burkhart et al.¹⁾ and Carlos et al.²⁾ performed open joint exploration with drainage and debride-

ment for joint infection with periarticular inflammation without bony involvement or bony involvement limited to the clavicular head. En-bloc resection was performed, such as of the medial third of the clavicle, cartilage portion of the first rib, and lateral half of the manubrium for the treatment of sternoclavicular joint infection with extensive adjacent bone involvement. Defects were covered by mobilization and rotation of the ipsilateral pectoralis major muscle. Zehr et al.³⁾ described split pectoralis major muscle flap reconstruction after clavicular-manubrial resection. Irrigation-suction has also been used in cases of pyogenic bone and joint infection after debridement^{4,5)}.

Primary closure is selected in cases of sufficient blood supply in the wound. Obtaining an aseptic wound is more advantageous than obtaining an infected wound when primary closure is performed. When the wound displays a poor blood supply, an appropriate muscle flap for the defect size is required.

In the present case with just such a septic wound with poor blood supply, obtaining soft tissue to cover the defect following en bloc resection would have been difficult. A sternocleidomastoid muscle flap is suitable for small- or moderate-sized defects, but not for large defects after en bloc resection⁶⁾. Antibiotic-impregnated porous hydroxyapatite blocks have been used as an antibiotic delivery system to control osteomyelitis⁷⁾. This system releases antibiotics slowly and maintains high concentrations around the block even after 18 days in vitro⁸⁾, and also provides excellent biocompatibility with bony tissue⁹⁾.

In our case, the sternocleidomastoid muscle flap could be used because a large defect from en bloc resection was avoided by using antibiotic-impregnated porous hydroxyapatite blocks to sterilize the wound.

Conclusion

Antibiotic-impregnated block placement may prove useful whenever local sterilization is required after debridement in the chest wall.

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