

Resection of Radiation-Induced Sarcoma of the Clavicle

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We report here the resection of a radiation-induced sarcoma (RIS) of the left clavicle developed in a 59-year-old woman 13 years after radiation for breast cancer. Surgery consisted of extirpation of the tumor with a combined resection of the total layer of the chest wall, the left brachiocephalic vein, and the left subclavian vein, reconstructed with a pediculated musculocutaneous graft using the right latissimus dorsi muscle. RIS of the clavicle is rare, and the prognosis might be poor. However, a complete removal of the tumor is feasible and can be performed safely. (Ann Thorac Cardiovasc Surg 2008; 14: 178–180)

Key words: radiation-induced sarcoma, clavicle, musculocutaneous graft, breast cancer

Introduction

Radiation-induced sarcoma (RIS) is a late complication after irradiation, and surgical removal is the only therapeutic option for cure. This report describes an unusual case demonstrating a huge tumor involving the left clavicle, which required a resection of the total layer of the chest wall.

Case Report

A 59-year-old woman with a huge mass at the left clavicle was referred to our department in August 2003. She had received an operation for synchronous bilateral breast cancers in 1989: a right mastectomy and lymph node dissection reconstructed with a pediculated left rectus abdominis muscle, and a left partial mastectomy followed by irradiation (70 Gy for the left breast and 51 Gy for the

left clavicle and axilla). Thirteen years later, a tumor developed at the left clavicle. Because irradiation (60 Gy) and systemic chemotherapy using ifosfamide and farmorubicine had no effect on the progression of the disease, surgical resection was indicated.

A chest computed tomography (CT) (Fig. 1, A and B) and magnetic resonance imaging (MRI) (Fig. 1, C and D) presented a mass at the medial side of the left clavicle measuring 70 × 60 × 40 mm that was surrounded by the left subclavian artery, the left brachial nerve plexus, and the left lobe of the thyroid. The tumor involved the left brachiocephalic vein (BCV) and the left subclavian vein (SV), and the entire left clavicle was destroyed (Fig. 1).

Surgery consisted of extirpation of the tumor with a combined resection of the total layer of the chest wall, the left lobe of the thyroid, the left BCV, and the left SV, reconstructed with a pediculated musculocutaneous graft using the right latissimus dorsi muscle. An anterolateral thoracotomy was performed in the left first intercostal space, and this proceeded to an upper median sternotomy. After a taping of the vessels and nerves (the left BCV, left vagus nerve, and left phrenic nerve), the first rib was resected, and the supraclavicular area was dissected with a combined resection of the left lobe of the thyroid. Because the left internal jugular vein was observed to be atrophic, it was sacrificed. After the distal part of the left

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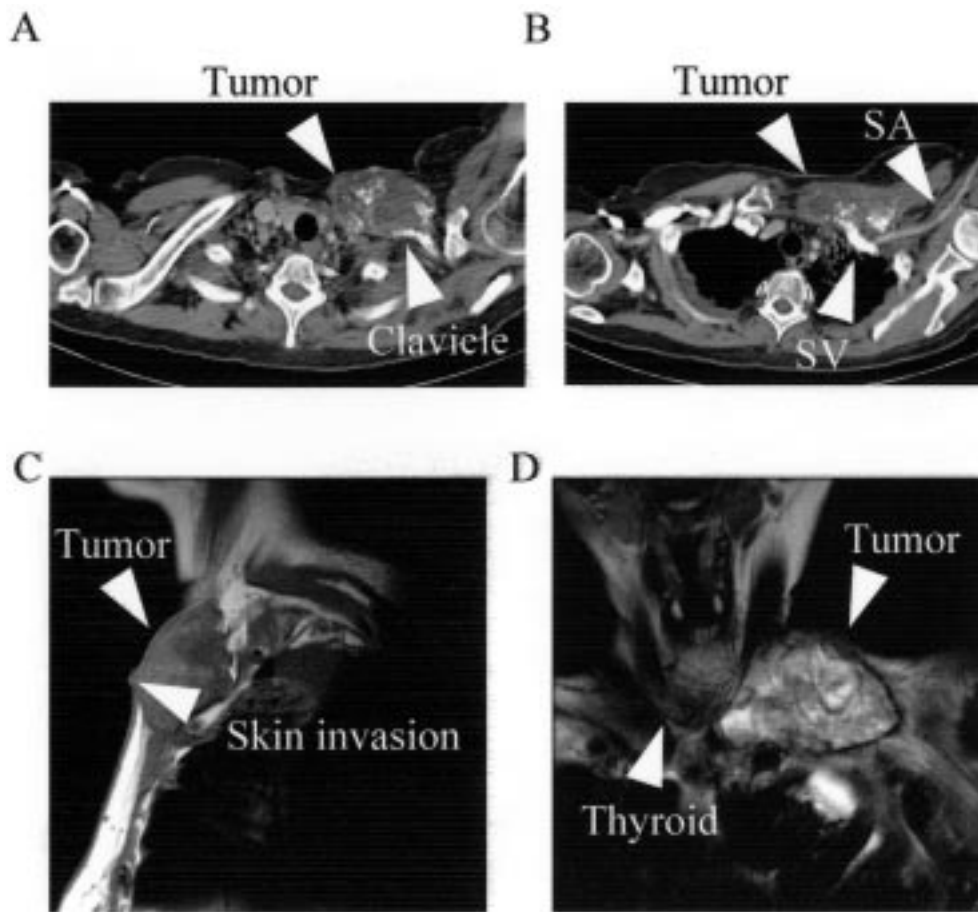


Fig. 1. Preoperative imaging.

A chest computed tomography (CT) (**A, B**) presents a heterogeneously stained solid mass destroying the left clavicle. Measuring $70 \times 60 \times 40$ mm, the tumor has directly invaded the skin and the left subclavian vein. Magnetic resonance imaging (**C, D**) shows the tumor surrounded by the thyroid and brachial nerve plexus and extending to the sternum. SA and SV, subclavian artery and vein.

clavicle was cut, the left axillary artery and vein were taped. The left common carotid artery and left subclavian artery were successfully spared, though the tumor involved the left BCV, the left SV, and the left phrenic nerve, all of which were sacrificed during the tumor extirpation (Fig. 2, A and B). After a fixation of the bony thorax, using two layers of Marlex mesh, a pediculated right latissimus dorsi muscle and a skin graft were designed at the right trunk in the left lateral position (Fig. 2C). Operating time was 16 h (7 h for extirpation), and blood loss was 1,850 g. The patient tolerated the procedures well and was monitored in the intensive care unit on the day of surgery. Her postoperative course was uneventful, and she started receiving additional irradiation on the 41st postoperative day. She died of recurrence at the back and bilateral lung 5 months after the operation;

however, the surgical margin was free from the disease at the time of death.

A microscopic examination revealed malignant fibrous histiocytoma (MFH), which showed diffuse proliferation of bizarre atypical cells with nuclear pleomorphism and hyperchromasia.

Discussion

The following diagnostic criteria for RIS have been proposed: (a) evidence of an initial nonmalignancy or malignant tumor of a different kind than the subsequent sarcoma, (b) development of the second malignant tumor in a previously irradiated field, and (c) histologic confirmation of sarcoma.^{1,2} This case meets the criteria, which were present 13 years after the resections of bilateral breast

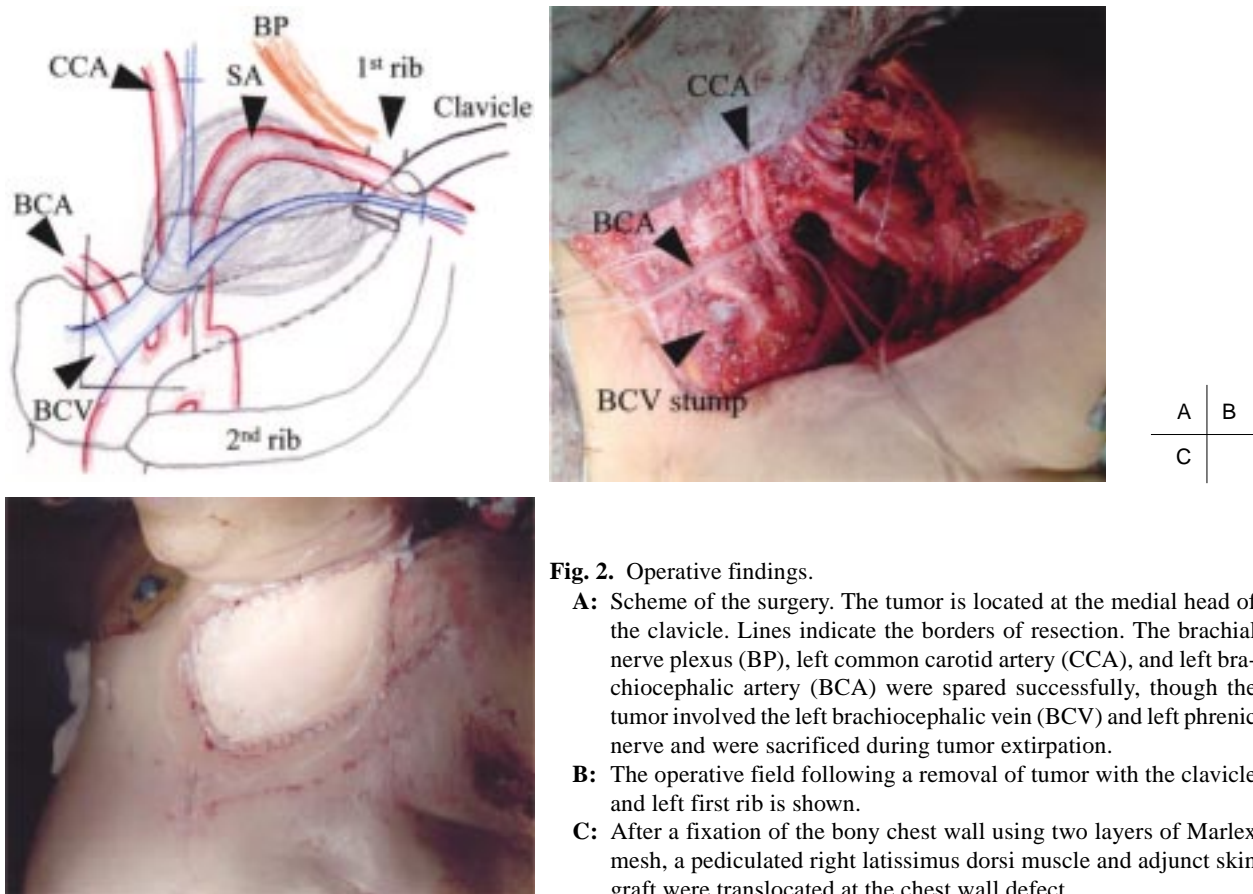


Fig. 2. Operative findings.

- A:** Scheme of the surgery. The tumor is located at the medial head of the clavicle. Lines indicate the borders of resection. The brachial nerve plexus (BP), left common carotid artery (CCA), and left brachiocephalic artery (BCA) were spared successfully, though the tumor involved the left brachiocephalic vein (BCV) and left phrenic nerve and were sacrificed during tumor extirpation.
- B:** The operative field following a removal of tumor with the clavicle and left first rib is shown.
- C:** After a fixation of the bony chest wall using two layers of Marlex mesh, a pediculated right latissimus dorsi muscle and adjunct skin graft were translocated at the chest wall defect.

cancer. Pathological study revealed an MFH-like sarcoma of the left clavicle, with no sarcomatous lesion present at the margin of the resected specimen.

The risk of RIS for the remnant breast after irradiation has been reported to range from 0.1% to 0.2% at 10 years.^{3,4)} According to a report of 34 RIS cases after partial mastectomy and irradiation for breast cancers, the mean latent interval from postoperative adjuvant radiotherapy was 152 months.⁵⁾ Tumor size was prognostic in this disease.⁵⁾ Here we successfully resected the tumor with no sarcoma at the margin. The reconstruction of the chest wall defect had to be performed in an unusual manner using the contralateral latissimus dorsi muscle and adjunct skin because of the following reasons: (i) the left SV was resected along with the tumor; (ii) the right axillar lymph nodes were dissected by the previous breast cancer surgery, and the right pectoralis major muscle could not be used for a graft.

Conclusion

The RIS of the clavicle has not been reported so far. A

poor prognosis could be expected because an extended removal of the tumor is not easily accomplished. However, we herein reported that a complete removal of the tumor is feasible and can be performed safely.

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