



Case report

A radiation ulcer that required partial lung resection and recurred in a small residual area of ectopic calcification

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ABSTRACT

Introduction and importance: Surgery for chest radiation ulcers must involve appropriate wide margins, but it is not usually possible to remove all radiation-damaged tissue. Therefore, it is difficult to determine how extensive such surgery should be. There have not been any reports about the recurrence of such ulcers years after surgery. In addition, how ectopic calcification should be treated and the need for partial lung resection in such cases have not been fully elucidated. We report the case of a patient who had a large severe radiation ulcer.

Case presentation: A 46-year-old patient underwent cancer resection and received postoperative radiotherapy. Seventeen years later, a chest ulcer developed. Computed tomography showed a depression of the lung parenchyma, which exhibited old radiation pneumonitis, and pathological fractures of the ribs around the ulcer. We excised a region of skin that exhibited a clear change in color together with an additional 1 cm around this area including 4 ribs and grossly calcified area. The lung was partially resected because of strong adhesion, and the chest wall was reconstructed. Two small calcifications remained and which required additional surgery several years later.

Clinical discussion: Since multiple surgeries were required, we consider that more generous resection margins were necessary from the beginning.

Conclusion: In such cases, it might be necessary to perform more extensive surgery that includes asymptomatic calcified areas.

1. Introduction

Postoperative radiotherapy for breast cancer is mostly beneficial, but associated with a number of complications [1]. Irradiation methods have improved, and the incidence of complications after radiotherapy seems to be decreasing [2]. However, in addition to acute complications, secondary tumor formation, lymphedema of the arm, radiation pneumonitis, cardiovascular disorders, and osteonecrosis have been reported as long-term complications [3]. Furthermore, chest radiation ulcers develop in 5 to 15% of long-term survivors [4].

Surgery for radiation ulcers must involve appropriately wide surgical margins [5]. However, it has been reported that it can be difficult to completely remove the irradiated tissue [6]. Therefore, it is difficult to determine how extensive such surgery should be.

Poor control of infections due to insufficient debridement has been reported in some cases, but there have not been any reports about the

recurrence of such ulcers several years after surgery. In addition, how ectopic calcification should be treated and the need for partial lung resection in such cases have not been fully elucidated [6].

We report the case of a patient who required chest wall reconstruction and partial lung resection, which subsequently recurred in two small regions of residual ectopic calcification.

This work has been reported in line with the SCARE criteria [7].

2. Patient (Figs. 1, 2, 3, and 4)

In October 1993, a 46-year-old patient underwent resection for right breast cancer and postoperative radiotherapy (50 Gy). There was nothing special to mention in the drug history and family history.

In May 2010, a chest ulcer was detected. Computed tomography (CT) showed a depression of the lung parenchyma and pathological fractures of the ribs around the ulcer. Old radiation pneumonitis was also noted in

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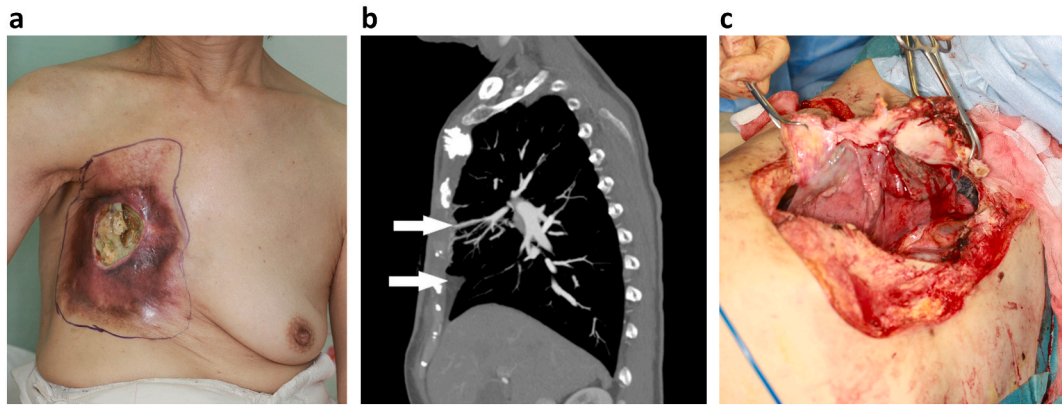


Fig. 1. At the first surgery.
 a. 19 × 17 cm of skin resected
 b. In addition to depression of the lung parenchyma, and traction bronchiectasis (arrow above) and pleural distortion in fissures (arrow below) could be observed.
 c. AT necrotic ribs resection, strong adhesion of lung to the necrotic tissue was observed.



Fig. 2. Mesh and titanium plate infection occurred
 A fistula opened at titanium plate fixation site.
 Mesh of 17 × 15 cm and titanium plate removed.

the lung parenchyma (Fig. 1b). In December 2011, we performed two-stage surgery. In the first stage, a latissimus dorsi musculocutaneous flap (L.D. flap) “delay” was carried out. The skin flap was designed to extend beyond the margins of the muscles to near lumbar/vertebral

area. The muscle had been detached from the dorsum, without its insertion being resected, two weeks earlier. In the second stage, we excised a region of skin that exhibited a clear change in color together with an additional 1 cm around this area. With help from a thoracic surgeon, the adherent and infected lung about 12 cm in diameter with the 3rd to 6th necrosed ribs was resected and closed using a linear stapler. Based on the thoracic surgeon’s advice, the chest wall was reconstructed with polypropylene mesh and a titanium plate. The defect was covered with a 24 cm × 20 cm “delayed” (L.D.) flap. The flap donor site was covered with a 3.0-fold meshed split-skin graft. The grossly calcified area was completely resected together with the overlying skin, but two small areas of ectopic calcification remained.

In June 2012, it was found that the mesh and titanium plate had become infected, and hence, they were removed (Fig. 2).

In September 2013, the ulcer recurred at the right first rib and sternum in the first calcified region. Debridement of the infected skin and necrotic clavicle, 1st and 2nd ribs, and part of the sternum were performed. The defect was covered with an 8 cm × 16 cm free right tensor fasciae latae muscle flap. The flap’s blood vessels were anastomosed to the superior thyroid artery and external jugular vein in an end-to-end fashion (Fig. 3).

In August 2018, an abscess formed on the ribs to which the previous plate had been fixed. Then, a fistula formed and expanded into the sternum and pericardium, where a second calcified lesion remained

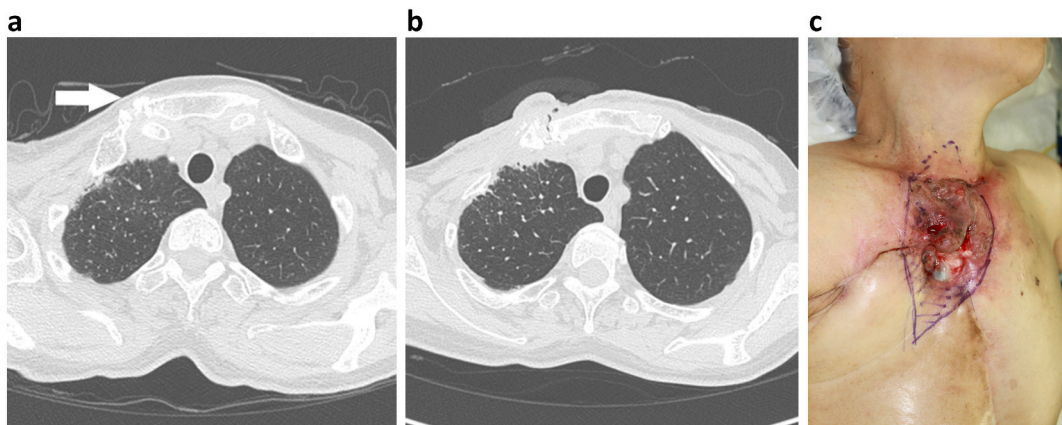


Fig. 3. The first recurrence of the ulcer 2 years after the first operation.
 a. Small ectopic calcification is observed between clavicle and sternum.
 b. Fistula and ulcer formed between sternum and clavicle, 1st, 2nd rib 2 years after the first operation.
 c. The fistula became ulcer and expanded to flap margin.

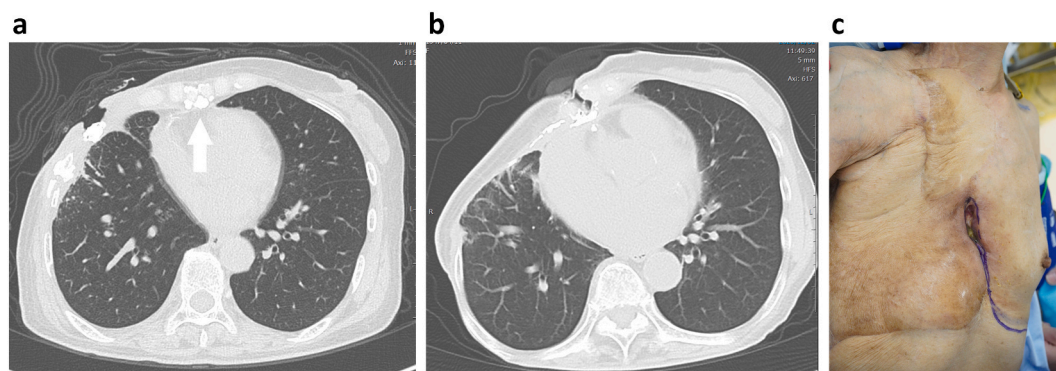


Fig. 4. Second recurrence 7 years after the first operation around lower-sternum
 a. Ectopic calcification is observed at lower end of the sternum before the first operation.
 b. An abscess was formed on the rib where the previously plate was fixated, and a fistula formed toward the lower calcified area.
 c. Clinical picture of fistula and flap design.

(Fig. 4). Heart failure was also diagnosed at this time.

In December 2020, Debridement of the fistula and pectoralis major flap delay procedure were performed. And the defect was covered by the flap two weeks after (Fig. 4). No tumor was found during biopsy examinations of the original or recurrent ulcers. Each time the condition worsened, it was adjusted to the patient's wishes, if surgery was possible at the patient's desired time.

3. Discussion

In the present case, a chest ulcer developed 17 years after radiotherapy, which involved the standard dose [5]. The risk of radiation ulcers are affected by the radiation dose and the patient's radiation tolerance and age. In this case, the ulcer was quite large; therefore, its treatment was particularly challenging.

If the total amount of radiation delivered to the chest exceeds 40 Gy, some lung damage is inevitable [3]. It has been suggested that the CT findings of old radiation-induced lung injuries include parenchymal changes, reductions in pulmonary volume, and pleural changes. The patient had all of these major findings and also exhibited fissure distortion and traction bronchiectasis (Fig. 1b) [8]. When a large area is affected by full-thickness osteoradionecrosis, reconstruction with mesh alone is recommended [5]. However, the use of plates, as was seen in our case, is effective for paradoxical breathing, but carries an increased risk of infection.

Few cases in which partial lung resection was required have been reported; therefore, we consider the current case to be very important.

Ectopic calcification is often seen around radiation ulcers, but the optimal treatment for such calcification has not been established [9].

There are no reports about the recurrence of radiation ulcers several years after chest reconstruction or the significance of ectopic calcification in such cases. The areas of small ectopic calcification in the current case, remained asymptomatic for longer than the ulcer itself (Figs. 3 and 4). However, they eventually caused an infection and recurrent ulcers at two and seven years after the first operation, respectively.

Although, from only one reported case, it may be sufficient to remove the area of ectopic calcification and insert a flap with good blood flow [10]. However, in cases involving the chest calcification is usually associated with bone or the pericardium, and hence, more careful pre-operative planning is required.

Since multiple surgeries were required in this case, we consider that more generous resection margins were necessary from the beginning. For larger defects, a bipedicle DIEP flap [11] with sufficient skin dimensions may have been appropriate.

In conclusion, we encountered a large severe radiation ulcer that required partial resection of the lung. A parenchymal depression and an old radiation injury were observed in the lungs. These findings may help

to determine the indications for lung resection in such cases. The grossly calcified area within the conventional margins was resected, but two small areas of calcification remained. These two areas required additional surgery several years after the initial surgery. In such cases, it might be necessary to perform more extensive surgery that includes asymptomatic calcified areas.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Ethical approval

It is considered that approval from such Board is not needed for this type of case report.

This judgment is based on the ethical consideration.

The corresponding author will take all responsibility for this judgment.

Consent

A written informed consent was obtained from the patient for the publication of this case report and accompanying images.

Guarantor

Masamitsu Kuwahara

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CRediT authorship contribution statement

Takashi Nakanishi, assistant surgeon, original draft writing.
 Masamitsu Kuwahara, surgeon, performed operation, wrote this manuscript.

Chikako Sasaki, assistant surgeon.

Junji Ando, doctor in charge.

Masayuki Harada, doctor in charge.

Mika Takeuchi, doctor in charge.

Declaration of competing interest

The authors declare no conflicts of interest associated with this manuscript.

There is no potential conflict of interest.

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