Presternal Soft Tissue Calcifications following Mediastinal Radiotherapy for Hodgkin's Disease*

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A patient is described in whom dense calcifications developed in the presternal soft tissues of the chest four years after mediastinal radiotherapy. This is believed to represent dystrophic calcification in previously normal but incidentally radiated tissues following standard dose radiotherapy to the mediastinum for stage IIA Hodgkin's disease.

Since the early 1920s the medical literature has been replete with reports of changes induced in normal and diseased tissues following radiation therapy for various malignancies. This is particularly so in Hodgkin's disease of the thorax.

The case presented here describes the development of dense calcifications in previously normal presternal soft tissues following radiotherapy in a patient with Hodgkin's disease of the mediastinum. To the authors' knowledge, such radiation-induced changes have not been reported previously.

**CASE REPORT**

A 32-year-old white woman was diagnosed at the age of 18 as having nodular sclerosing Hodgkin's disease of the mediastinum, stage IIA. Following staging laparotomy and splenectomy, she underwent radiotherapy with 4,000 rads to the upper mantle and "inverted-Y" fields, along with splenic pedicle radiation. She also received six courses of MOPP chemotherapy (nitrogen mustard, Oncovin, procarbazine and prednisone). She tolerated therapy well and achieved complete remission; however, within six months she developed post-radiation pericarditis. This was successfully treated with a partial pericarectomy via a left posterior thoracotomy.

Following this, the patient was asymptomatic with mild cutaneous atrophy and fibrosis over the intrammary, presternal area as the only physical manifestation of radiotherapy. The breasts were not involved. A chest radiograph two years after completion of radiotherapy showed only residual mediastinal widening and post-radiation mediastinal fibrosis. The presternal soft tissues and sternum appeared entirely normal. A lateral chest radiograph four years after therapy demonstrated the first evidence of early calcifications, as faint, nodular densities in the presternal area (Fig 1a). The calcifications became more evident clinically by six years after treatment, as multiple, hard, readily palpable nodules that were occasionally tender with pressure. The distribution of the nodules extended laterally on each side of the midline to the medial breast reflections, and cephalocaudally to the sternomambral joint above and stern-

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![Figure 1a (left) and b (right). Sternal area from lateral chest radiographs four years and 13 years after therapy.](image1.png)

**DISCUSSION**

Since the initial use of radiation as a therapeutic modality and its subsequent wide application to a number of malignant diseases, many radiographic changes in normal and diseased tissues have been described. This is particularly true in the xiphoid junction below. Later radiographs revealed progressive density and a conglomerate, plate-like nodularity of the calcifications, best demonstrated on the lateral view (Fig 1b). Computed tomography 13 years after therapy demonstrated the dense calcifications in the presternal area (Fig 2).

![Figure 2. Thoracic CT scan.](image2.png)
thorax. Groover et al in 1922 were the first to report observations of intrathoracic changes secondary to radiation therapy. This has been followed by numerous reports describing and classifying the acute and delayed changes induced by radiation therapy involving the lungs, pleura and mediastinum.

Thoracic calcifications as a consequence of radiation therapy occur infrequently and when occurring, are found in radiated foci of previous malignant involvement. Wyman and Weber reported calcifications in intrathoracic nodes involved with Hodgkin’s disease following radiation in 1951. Strickland et al (1967) described four instances where calcifications developed at the site of Hodgkin’s infiltration of the lung and nodes following direct radiation. Since these descriptions, several authors have reported additional cases of calcifications occurring in radiated intrathoracic nodes involved with Hodgkin’s disease. These calcifications have generally developed no sooner than one year following therapy and often more than five years later.

Presternal soft tissue calcifications, as described in this patient, developing in previously normal tissues incidentally radiated in the treatment of mediastinal Hodgkin’s disease have not been previously described. It is believed that this also represents the first documentation of calcifications occurring at any site in the thorax, in tissues entirely normal prior to incidental radiation. This phenomenon has, however, been described in extrathoracic sites. Deeths and Stanley reported the occurrence of pelvic calcifications in previously normal tissues following parametrial injections of radioactive gold 198 (Au) in patients treated for cervical carcinoma. Calcifications in normal intracranial structures incidentally radiated have also been described. Harwood-Nash and Reilly described this in two cases of basal ganglia calcifications in children receiving radiation of the cranial vault. Similar cases have since been reported.

In our patient there was no antecedent disease or surgery involving the prestenral soft tissues. The sternum was not involved with Hodgkin’s disease nor did radiographs demonstrate post-radiation bone changes. There was no evidence for a granulomatous infection such as tuberculosis or histoplasmosis, both recognized as causing thoracic calcifications, generally involving the mediastinal and hilar nodes, as well as lung parenchyma, but not in a pattern or distribution such as this. Additionally, there was no history of an inhalational disease such as silicosis which may produce “eggshell” calcifications of hilar nodes, but may also affect nodes of the anterior and posterior mediastinum, the thoracic wall and occasionally the retroperitoneal and intraperitoneal nodes.

Calcinosus circumscripta, which occurs in a variety of systemic diseases, particularly metabolic disorders or collagen vascular diseases, is a condition where depositions of calcium occur in the subcutaneous tissues. Usually, however, these deposits are found in the extremities and around joints, such as in sclerodera, hyperparathyroidism or hypoparathyroidism. There were no such findings in this patient, nor were associated systemic findings present. Serial chest radiographs show the evolution of these calcifications, first evident four years after receiving standard-dose radiotherapy for her stage IIA Hodgkin’s disease. The lateral view best demonstrates the findings as their central location causes them to be largely obscured by superimposed bony and mediastinal structures on the PA projection (Fig 3). The distribution of the calcifications was limited to those tissues showing the initial radiation-induced atrophy and fibrosis. The involved area was slightly narrower than the width of the radiation port and this was most likely due to the attenuating effects of the breast tissues on the incident radiation in the outer margins of the ports. The depth of the soft tissue involvement, as demonstrated by lateral radiographs and CT scan, and the plate-like, conglomerate nodularity of the calcification pattern, suggests that several tissue layers were involved, including dermal, fatty and muscular elements, more than would be expected from changes induced in the small chain of prestenral nodes alone. The etiology of these prestenral calcifications, therefore, probably represents a subclinical, radiation-induced, multilayer tissue necrosis with the delayed development of fibrosis and dystrophic calcifications.

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